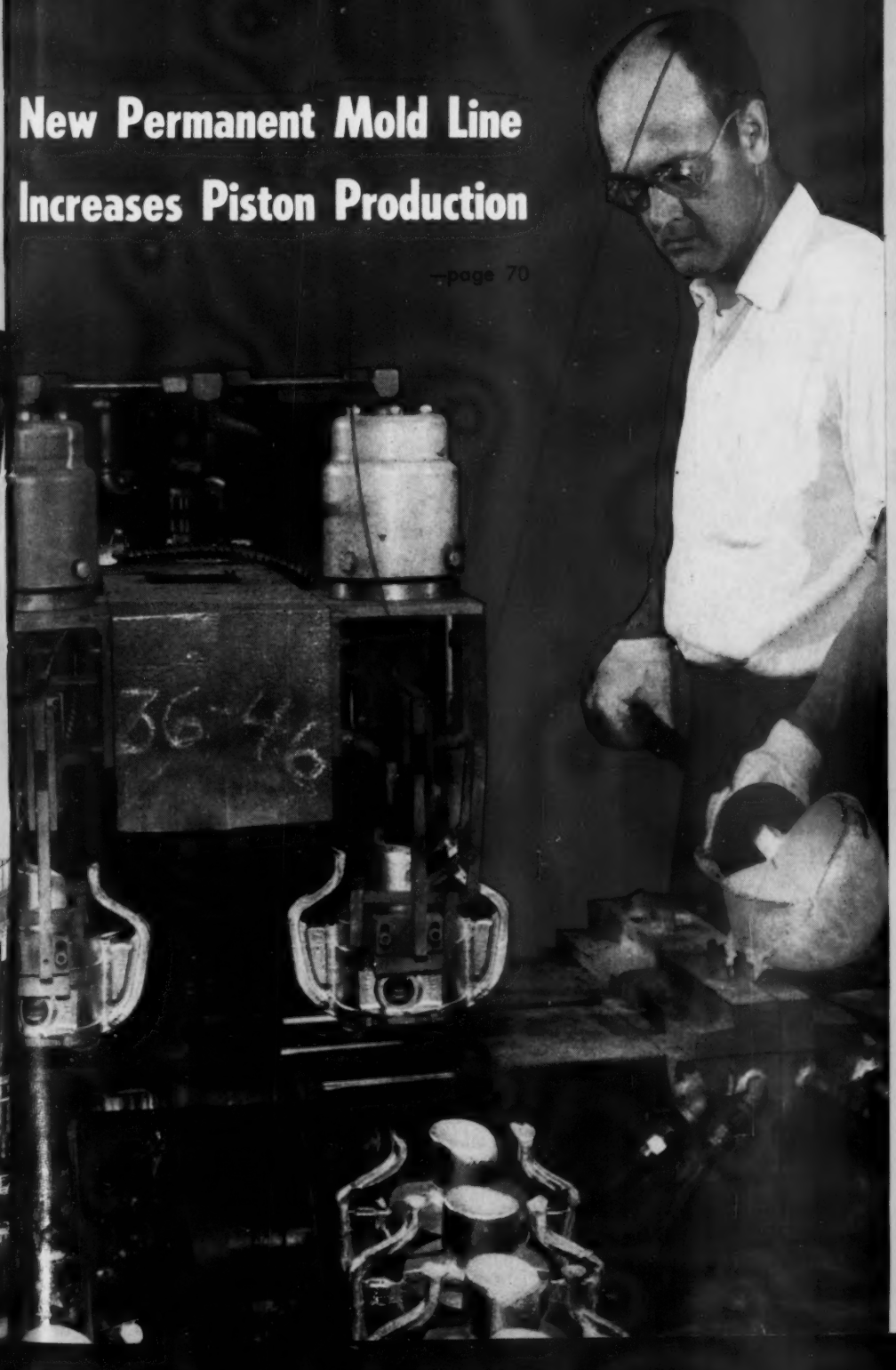
FOUNDRY

AUGUST
1956

CENTON PUBLICATION

New Permanent Mold Line Increases Piston Production

—page 70



Gases in Iron and Steel

Much research is necessary before gas behavior is understood and cures for gas troubles are found

—page 80

Cast Boron Steel

Newly developed normalized and drawn cast steel is readily weldable, has good tensile properties

—page 92

Brass Casting Defects

Here are ten more flaws which can occur in brass castings and ways to correct the trouble

—page 88

Foundry Molding Sands

A number of things must be considered in selecting the proper sand for a particular casting job

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Torpedo Tube Patterns

Specialized pattern equipment is required for centrifugal casting of these nonferrous cylinders

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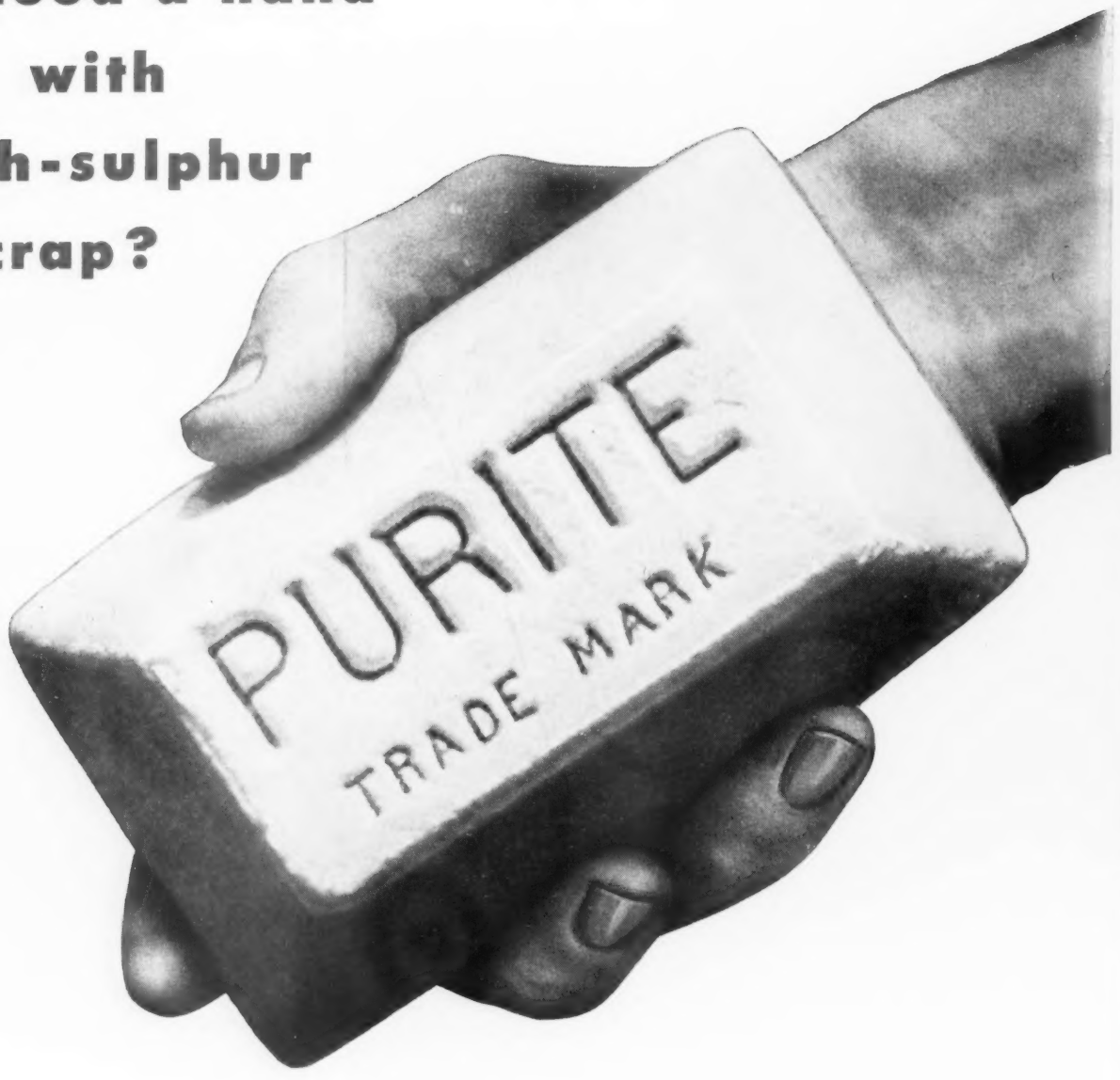
need a hand with high-sulphur scrap?



Your best antidote for high-sulphur scrap is Purite. Used in the cupola and in the ladle, Purite assures cleaner iron and adds to the soundness, strength and machinability of the finished castings.

In the cupola, Purite can produce a sulphur reduction as high as 25% . . . in addition to increasing the fluidity of the cupola slag, speeding combustion reactions, and preventing bridging. In the ladle, Purite desulphurizes the iron to specification and provides clean, quiet-pouring metal of uniform analysis.

For over 30 years, Purite has been the choice of progressive foundrymen. The convenient 2-pound pigs of fused soda ash are familiar everywhere. Purite is distributed by leading supply houses in every area . . . for the name of the one nearest you or further information, write—

MATHIESON CHEMICALS
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MATHIESON INDUSTRIAL CHEMICALS DIVISION • BALTIMORE 3, MD.

3875

Circle 551 on Inquiry Card—Page 201

A remedy for bouncing bodies

...or how Chuck Wright cut down rejects from 15 to 2%

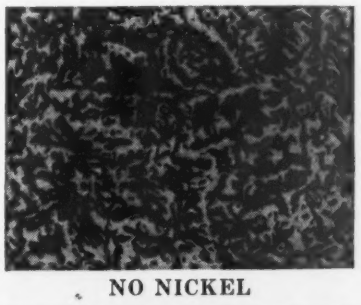
"'Chuck, look at these rejects. They been givin' me nightmares'."

"That's the way Hank Owens of Dexter Foundry put his trouble to me. Hank had a number of bodies bounce back from a maker of diaphragm control valves. The kind used in chemical and pulp and paper plants, 1½" to 3" sizes with pressure ratings of 125 to 250 psi.

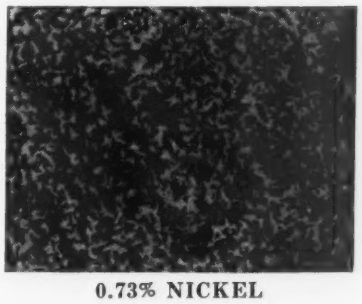
"Why so many rejects? Leakers and machining troubles. Leakers chiefly, found on pressure test after costly machining was complete. What Hank couldn't find out was the cause.

"Fortunately, I'd run into this situation in the past. We checked out gating, risering and sand conditions, they were perfect. So were cores. The gray iron met ASTM A-126-42, Class B specs, calling for a tensile of 31,000 psi. It was tapped hot enough to meet the desired pouring temperature, right on the nose.

"Yet when the customer's hydrostatic test gave these castings three times their rated pressures, the rejects ran about 15%. The only possibility left was that coarse grain was causing the trouble.



NO NICKEL



0.73% NICKEL

"So, showing Hank these two pictures, I explained how he could break up the large graphite flakes to get denser, uniform grain... and virtually eliminate leakage... by simple modification of his base chemistry particularly silicon content and addition of 1% nickel in the ladle.

"Today, Hank pours 1% nickel cast iron, and comfortably exceeds the customer's strength specification. What's more, he sliced his rejects on leakers to 2%. And the happy customer gets bodies that speed through his machining operation.

"When your problem involves the metallurgy of castings, let's put our heads together. Maybe I can help you, too. Easiest way to reach me is through INCO."

Chuck Wright

INCO TRADE MARK

The International Nickel Company, Inc.

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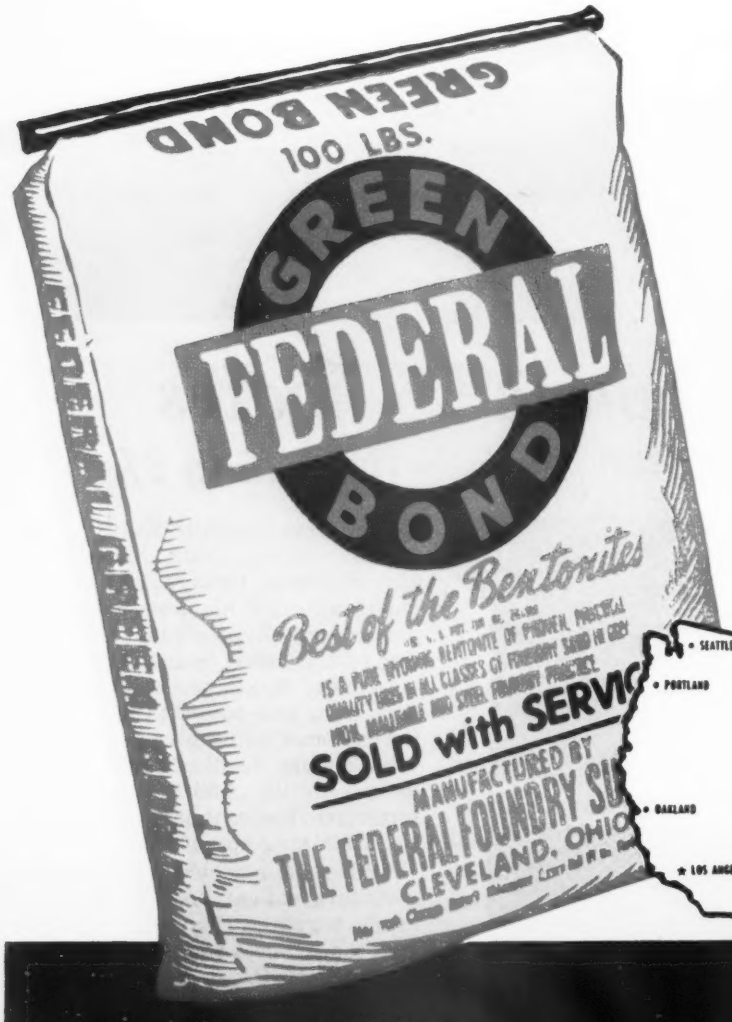
FEDERAL GREEN BOND ...THE ONLY BENTONITE WITH "NATURAL" LOW VISCOSITY

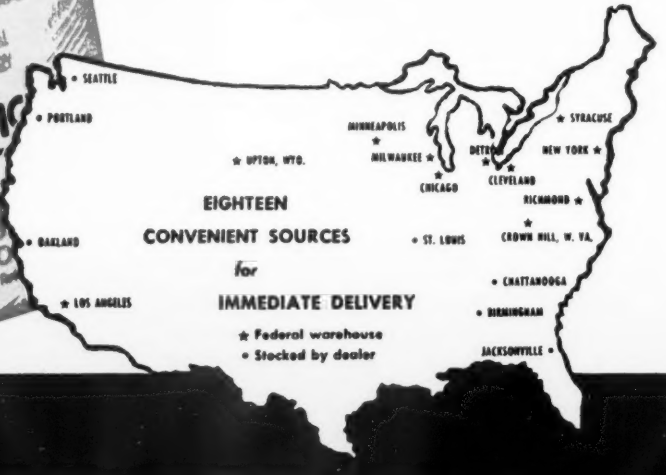
Low viscosity is a *natural characteristic* of the bentonite clay from which FEDERAL GREEN BOND is produced — *not* a property acquired through adding certain chemicals. FEDERAL engineers "test-drill" bentonite deposits *before* mining — select only those lots with a *natural low viscosity* for production of FEDERAL GREEN BOND.

FEDERAL GREEN BOND is a pure mineral product—*unadulterated, untreated.* It contains no chemicals or other ingredients detrimental to foundry sands or conditions. Its low viscosity, its ability to develop and control HIGH green and dry bond strength, its exceptionally high Ph rating (9.0) and its unerring uniformity are inherent qualities that just "come naturally" in FEDERAL GREEN BOND.

Therefore, if you want to use a bentonite that *just naturally* lets you temper your sand with lower moisture content, develop optimum strength and *save mulling time*—change to FEDERAL GREEN BOND. If you use bentonite in slurry form and want to add up to *25% more bentonite per gallon of water* for a more potent slurry, thus enabling you to provide better control of moisture content and sand strength — change to FEDERAL GREEN BOND, the best of the bentonites.

FEDERAL GREEN BOND is available in either pulverized, granular or the *quick dispersing* slurry grade—at 18 convenient distribution centers throughout the U.S.A. (see map below). Also available throughout Continental Europe.





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THE FEDERAL FOUNDRY SUPPLY CO.

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FOUNDRY
A PENTON PUBLICATION

August 1956
Volume 84—Number 8

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Picker x-ray

Circle 556 on Inquiry Card—Page 201

Circle 557 on Inquiry Card→

Held at 3000°F for five hours, these four brick, commonly recommended to resist high temperatures, show varying effects. Samples 1, 2, and 3 softened and slumped to different degrees, indicating loss of usefulness even below this temperature. Sample 4, a Mullfrax® electric furnace mullite refractory, is unaffected by the heat.

fourth in a series . . . **HEAT RESISTANCE**

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Heat Resistance—Exposed only to heat, Carborundum's Super Refractories can actually be used with complete safety at temperatures above 3000°F. Long before such temperatures are approached, even high heat duty and super-duty firebrick lose much of their usefulness. That's because they begin to soften several hundred degrees below their theoretical safe limits. Not so Carborundum's Super Refractories. Their strength and rigidity are maintained close to their theoretical limits.

In practice, of course, you must contend with many more conditions than heat alone. Corrosion, thermal shock, load, abrasion, erosion, etc., are usually combined with temperature. This combination of conditions may tend to lower heat resistance of refractories. That's why a refractory cannot be selected solely on its ability to withstand temperature. It also explains the reason Carborundum offers so many specialized refractories.

Heat resistance is thoroughly explored in the forthcoming issue of Carborundum's new magazine "Refractories." Send for your copy today.

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METALITE . . . Tops for removing flash from difficult inside contours.

Polishing a parting line on a non-ferrous casting

With Behr-Manning Abrasive Belts on hand, the job is both easy and highly productive. Foundries all over the country are finding these fast-cutting, long-lasting belts the answer to increased output with far better finishes.

Try a Behr-Manning Coated Abrasive Belt on your next grinding, polishing or finishing operation. A Behr-Manning Field Engineer will gladly demonstrate in your foundry or at a nearby Behr-Manning Demonstration Room. Call him today, or write Behr-Manning Co., Troy, N. Y., Dept. F-8.

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P-3

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NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories

Spotting flaws in castings

Foundry cast component — inspected by high-speed Ansco Superay "A" film.

Ansco watches over quality for foundries

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Versatile! A "Workhorse" film!

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THE RIGHT CHEMICALS FOR PERFECT PROCESSING RESULTS:
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When Ansco introduced the first x-ray films tailored especially for industry, radiographic inspection gained important new value for foundrymen.

With high-speed Ansco Superay "A" film, for example, you can examine large lots of castings and forgings on a partial or even 100% basis—swiftly, non-destructively! You can insure quality right in your shop, furnish proof of quality to your customers, enhance your reputation for reliability. Another Ansco film extra-fine grain "B", makes diagnostic readings easier during development of a pouring practice.

Are you broadening your use of radiography? Or establishing it for the first time? Ansco films and chemicals are backed by over a century of skill, by exhaustive chemical research, by experience on a broad variety of accounts (serviced, always, on a personal basis). Let Ansco watch over your quality.

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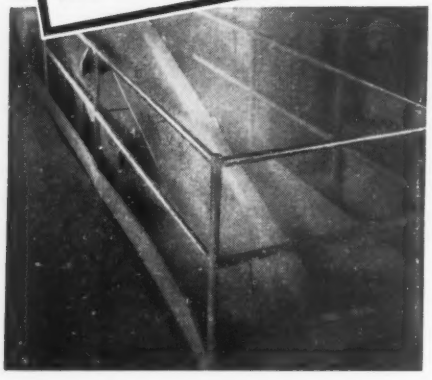
All the "hot stuff" in this foundry rides Imperial Belts



Imperial INNERLOCKED* Belts have won top position handling hot foundry sand in The McNally Pittsburgh Foundries, Inc., plant, built in 1945.

On the conveyor shown above, an Imperial Super-Insulated Sahara Belt (80′ x 24″ x 6-ply) carries searing, sizzling shakeout sand so hot it requires the heat-resisting capacity of Imperial's 600° belt.

Best for foundry service. Many foundries throughout this country and Canada use only Imperial belting on their "hot" conveyors and elevators. Experience has shown this heavy-duty canvas belting with its exclusive INNERLOCKED* stitching and superior heat-resistant impregnating compounds lasts much longer than lesser belts.

Asbestos layers withstand temperatures to 600°F. For protection from severe impact and abrasion, metallic reinforcement is available at no extra cost.

Job-designed belting. Whatever your needs, there is an Imperial Belt job-designed to give you lowest ultimate belt cost and highest day-to-day operating satisfaction. Write for Data Sheet 54-2 which describes Imperial Belts for foundry service.

**INNERLOCKED—Reg. trade name of Imperial Belting Co.*

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1755 S. Kilbourn Ave., Chicago 23, Ill.

You expect MORE from Imperial . . . and you get MORE!

Circle 560 on Inquiry Card—Page 201

With the Editors

REMARKABLE RECORD: August Van Lantschoot, president and manager, and his wife, Martha Smessaert Van Lantschoot, treasurer and office manager, Fairfield Aluminum Castings Co., Fairfield, Iowa, have the unique distinction of

having served a combined total of 100 years in the foundry industry. Both were born on Nov. 28, 1889, and both have enjoyed 50 years of continuous service in the malleable, gray iron and aluminum casting industries.

August came to this country from Belgium in 1906, and his first job was unloading coal from railroad cars at the Iowa Malleable Iron Co., Fairfield. Later he was a squeezer and floor molder and at the age of 21 was made shipping clerk. In the fall of 1919 the company gave him the opportunity of studying in the laboratories of the Malleable Iron Research Institute (predecessor of Malleable Founders' Society), Troy, N. Y., under the late Prof. Enrique Touceda. Upon returning to Fairfield, August was made metallurgist and assistant superintendent and in 1925 became general manager of the Iowa plant. In 1945 he resigned to organize the Fairfield Aluminum Castings Co., which now employs approximately 70 and is contemplating a third plant addition. August has participated in numerous society research projects and has contributed papers before technical meetings.

Martha Van Lantschoot came from South Bend, Ind. Her first office position, six years prior to her marriage, was with the old Meyer Foundry & Mfg. Co., South Bend. Later she became bookkeeper at Iowa Malleable Iron Co. and held that position for 34 years. She has been with Fairfield Aluminum Castings Co. for the past ten years.

Congratulations to both these fine people for such remarkable records.

—o—

Past Presidents Meet: The past presidents of the Wisconsin Chapter of AFS are a loyal group. Usually as many as possible get together for a visit at the annual convention of the society. The accompanying illustration shows six in attendance at Atlantic City. Bottom row (l to r): A. F. Pfeiffer, Allis-Chalmers Mfg. Co., West Allis, Wis.; William J. MacNeill, Federal Malleable Co., Milwaukee; Joseph G. Risney, Risney Foundry Equipment Co., Milwaukee. Top row (l to r): John Bing, Metropolitan Refractories Corp., Kearny, N. J.; R. V. Osborne, Lakeside Malleable Castings Co., Racine, Wis.; Walter W. Edens, Allis-Chalmers Mfg. Co., West Allis, Wis. During the week I saw the following three past presidents who did not get into the picture: Roy M. Jacobs, Standard Brass Works, Milwaukee; B. D. Claffey, Dayton Malleable Iron Co., Dayton, O.; George K. Dreher, Steel Founders' Society of America, Cleve-

land. Others may have been there. The photograph was supplied by John Bing, who for many years was also the official photographer of that chapter.

—o—

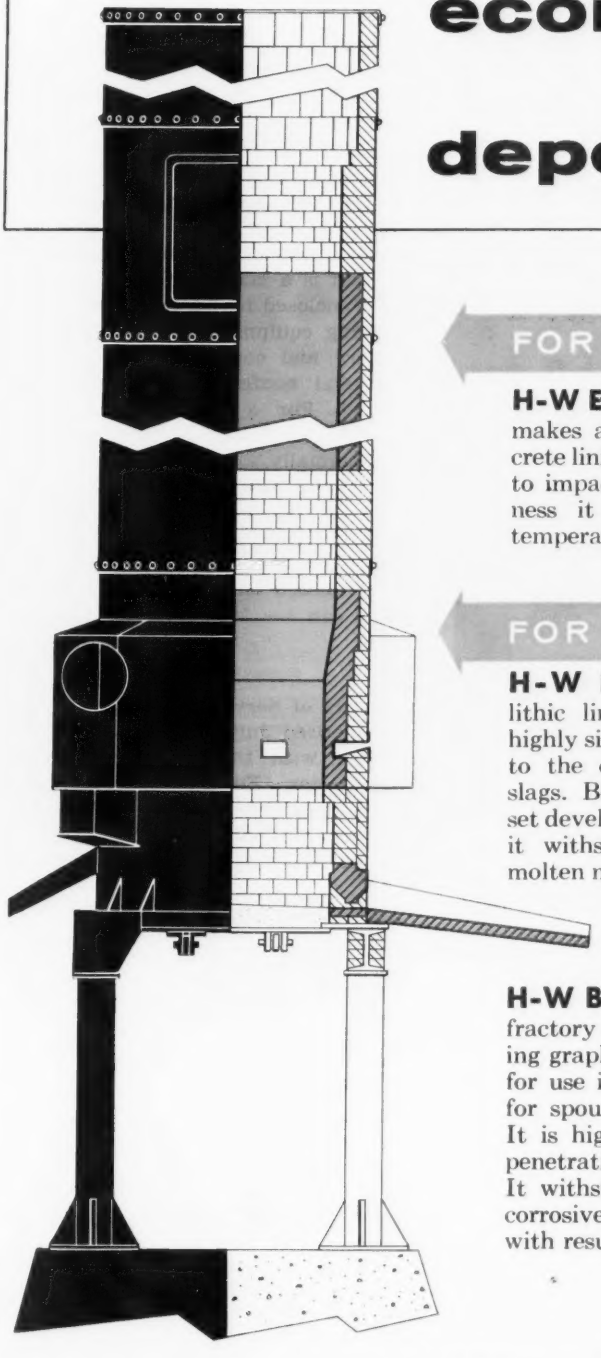
Minstrel Air: Exhibitors at modern industrial shows are using many gimmicks to attract attention. At Atlantic City, proud papa "Mr. Helspot," portrayed by Frank E. Haas of the Philadelphia office of Mexico Refractories Co., paraded the boardwalk and throughout the hall to invite foundrymen to see his new

baby, Helspot unburned graphite base brick, at the company's booth. The illustration shows Mr. Haas in his costume, the Mexico display and ladies (supplied through courtesy of

Harbison-Walker *Monolithic* cupola linings

economical to install and maintain...

dependable in service...



FOR THE CHARGING ZONE

H-W Extra Strength Castable makes a hard, strong refractory concrete lining which is extremely resistant to impact and abrasion. In refractoriness it is adequate for service at temperatures up to 2400°F.

FOR THE MELTING ZONE

H-W Kuplomix provides monolithic linings free from joints. It is highly siliceous and extremely resistant to the corrosive action of non-basic slags. Because of the strong ceramic set developed at working temperatures, it withstands the erosive action of molten metal and slag to a high degree.

FOR THE BOTTOM ZONE

H-W Black Patch is a plastic refractory of super-duty quality containing graphite, which is especially suited for use in the cupola breast wall and for spouts, runners and ladle linings. It is highly resistant to wetting and penetration by molten iron and slags. It withstands the severe erosive and corrosive action of metals and slags with resultant longer service life.

In addition to the above, Harbison-Walker products include all classes of commercial refractories for every foundry requirement.

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World's Largest Producer of Refractories
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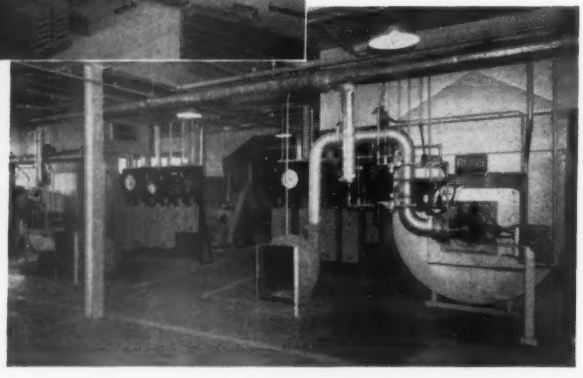
Circle 561 on Inquiry Card—Page 201

Automation comes to CORE BAKING with modern ROSS Ovens

View from entering end of ROSS oven showing catwalk and conveyor drive, with heater and air tempering coils housed above oven.



ROSS heating equipment showing burner end of heater, recirculating ductwork, filters, etc. Note compact grouping of controls and starting equipment.

ROSS Overhead Nozzle System Insures Uniform Air Distribution

For one of America's leading automobile manufacturers, core baking has been really mechanized to effect sizable savings in material and operating costs. The two ROSS Horizontal Core Bake Ovens, each complete with heating and cooling equipment, are designed with conveying apparatus both inside and outside of the oven.

Each oven consists of 4 baking passes and 2 cooling passes in a separate insulated enclosure. Rows of specially designed and directed nozzles insure even distribution of treated air.

ROSS Conveyorized Core Baking Systems can prove a paying investment for large or small foundries. Write us for detailed information.

Inquire about the ROSS Hot Blast Heating System that greatly increases tonnage while saving coke, labor and repairs. Can be installed with no interference with melting schedules.

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Circle 562 on Inquiry Card—Page 201

Modern Equipment Co., Port Washington, Wis.) lined with the company's products.

—o—

Men Needed: The Museum of Science and Industry, Jackson Park, Chicago, is looking for two men—preferably retired foundrymen—to operate its fully equipped foundry. One man would function as supervisor and the other as a molder and general helper.

That foundry exhibit was opened to the public in 1940 after three years of effort on the part of the Museum and the Chicago Chapter of AFS. It is a modern, air conditioned, glass enclosed foundry with full sized working equipment, a sand test laboratory and core department. Gray iron and nonferrous metals can be melted. For a time during World War II, the iron foundry operated commercially, making small war castings at the rate of several hundred pounds per day. This activity provided training for students of Washburn Trade School and also supplied needed castings. Anyone interested can see Mr. Patre, of the museum.

—o—

Years of Service: Catharine Flynn, who retired July 1 after 43 years of service with the National Foundry Association (FOUNDRY for July, page 226), was the guest of honor at a luncheon late in June at the Union League Club, Chicago. The staff of

NFA and a number of past presidents were present to express appreciation to Miss Flynn for her many contributions to the association in its service to the foundry industry.

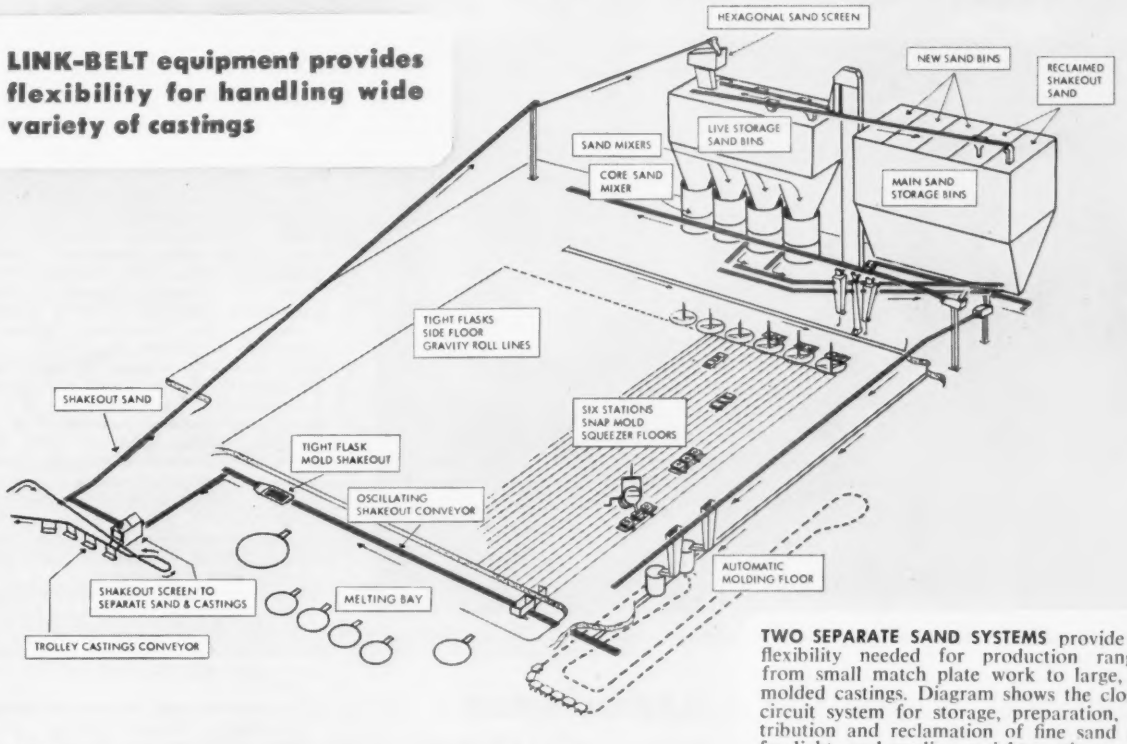
The accompanying illustration shows Miss Flynn with NFA vice president Arthur G. Hall, Nordberg Mfg. Co., Milwaukee (left) and past president Herman Menck, Harnischfeger Corp., Milwaukee (right). Top row left to right are past presidents Summerfield Brunk, Headford Bros. & Hitchins Foundry Co., Waterloo, Iowa; H. E. Ladwig, Allis-Chalmers Mfg. Co., Milwaukee; A. V. Martens, Pekin Foundry Co., Pekin, Ill.

I was privileged to attend and enjoyed the affair greatly. F.G.S.

General Metals jobbing foundry approaches

full mechanization

LINK-BELT equipment provides flexibility for handling wide variety of castings

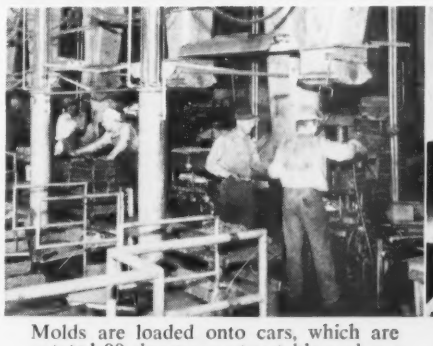


LINK-BELT

TWO SEPARATE SAND SYSTEMS provide the flexibility needed for production ranging from small match plate work to large, pit-molded castings. Diagram shows the closed-circuit system for storage, preparation, distribution and reclamation of fine sand and for light- and medium-weight castings.

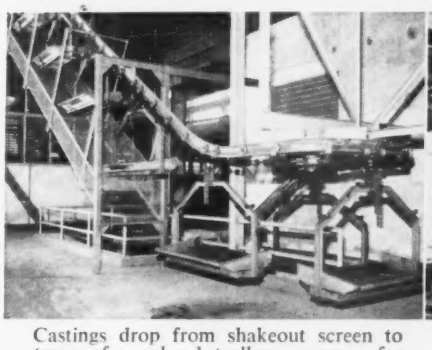
THE variety of castings produced by job shops multiplies handling problems. But the Oakland (Calif.) plant of General Metals Corp. proves that mechanization is both possible and practical. Here Link-Belt equipment—including special machinery designed specifically for this installation—speeds production of castings ranging from one pound to seven tons. Other benefits include minimized manual handling, improved working conditions.

Link-Belt engineers can plan an entire conveying and sand preparation system for you . . . and follow through with a complete line of equipment to help you produce better castings at lower cost. For one machine or complete engineering, call your nearest Link-Belt office. For complete information, write for Book 2423. 14,207



Molds are loaded onto cars, which are rotated 90 degrees on turntable and run off on tracks to pouring and storage line.

Semi-automatic device dumps sand and castings onto oscillating conveyor. Cars return by gravity to molding stations.



Castings drop from shakeout screen to trays of overhead trolley conveyor for delivery to cleaning bay.

Unique Link-Belt "Manipulator" carries up to eight tons of castings to annealing ovens, quench tanks or storage.

LINK-BELT

CONVEYORS AND PREPARATION MACHINERY

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

Ask Standard ⋮ *how to cut costs with conveyors*

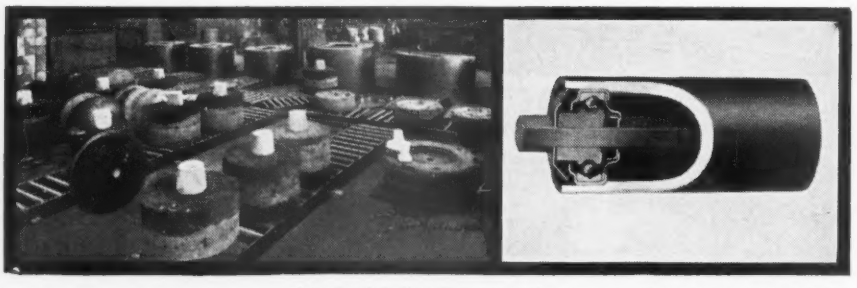
Typical pouring floor with molds on parallel lines of roller conveyors.

Use our specialized experience to good advantage in your foundry

STANDARD Conveyor Company has a record of 50 years of service to foundries and allied industries. This experience can be put to work to help you cut your costs . . . simplify material handling . . . free expensive manpower.

Here's your opportunity to get a perfect combination of long, dependable service with maximum flexibility. Quality-built Standard units are offered in a wide range of stock types and sizes that allow custom-engineering at standard unit prices.

Before you invest in new equipment, get the facts from Standard on powered as well as gravity conveyors in both permanent and portable models. STANDARD CONVEYOR COMPANY, General Offices: North St. Paul 9, Minnesota. Sales and Service in Principal Cities.



Standard Roller Conveyors feature especially-designed shielded bearings. On the job, shields keep out spillage and sand, give longer, trouble-free roller life.

For details, see the Standard Engineer listed in the phone book or write for Bulletin 309. Address Dept. N-8

Sales and Service in Principal Cities.

Circle 564 on Inquiry Card—Page 201

Calendar of MEETINGS

Sept. 1-9—International Foundry Congress and Trade Fair, Dusseldorf, Germany.

Sept. 9-12—National Metal Trades Association, eastern plant management conference, Essex-Sussex Hotel, Spring Lake, N. J.

Sept. 11-13—American Die Casting Institute, annual meeting, Edgewater Beach Hotel, Chicago.

Sept. 16-21—American Chemical Society, annual meeting, Convention Hall, Atlantic City, N. J.

Sept. 16-22—American Society for Testing Materials, Pacific area national meeting and apparatus exhibit, Hotel Statler, Los Angeles.

Sept. 17-21—Instrument Society of America, instrument-automation conference and exhibit, Coliseum Bldg., New York.

Sept. 24-25—Steel Founders' Society of America, annual fall meeting, The Greenbrier, White Sulphur Springs, W. Va.

Sept. 24-26—Material Handling Institute, fall meeting, The Greenbrier, White Sulphur Springs, W. Va.

Sept. 25-28—Association of Iron and Steel Engineers, iron and steel exposition, Public Auditorium, Cleveland.

Sept. 27-29—National Association of Foremen, annual meeting, Jefferson Hotel, St. Louis.

Oct. 4-5—Magnesium Association, annual meeting, Drake Hotel, Chicago.

Oct. 8-12—American Welding Society, fall technical meeting, Hotel Cleveland, Cleveland.

Oct. 8-12—American Society for Metals, national metals congress and exposition, Public Auditorium, Cleveland.

Oct. 11-12—Armour Research Foundation, national noise abatement symposium, Hotel Sherman, Chicago.

Oct. 11-12—National Foundry Association, annual meeting, Sheraton-Cadillac Hotel, Detroit.

Oct. 18-20—Foundry Equipment Manufacturer's Association, annual meeting, The Greenbrier, White Sulphur Springs, W. Va.

Oct. 19-20—New England Regional Foundry Conference, Massachusetts Institute of Technology, Cambridge, Mass.

Oct. 19-20—Northwest Regional Foundry Conference, Seattle, Wash.

Oct. 22-26—National Safety Council, safety congress and exposition, Conrad Hilton, Congress, Morrison and La Salle Hotels, Chicago.

Oct. 25-26—Metals Casting Conference, Purdue University, Lafayette, Ind.

Oct. 20-23—Conveyor Equipment Manufacturers' Association, annual meeting, The Greenbrier, White Sulphur Springs, W. Va.

Oct. 29-30—Refractories Institute, fall meeting, The Homestead, Hot Springs, Va.

Oct. 31-Nov. 2—Gray Iron Founders' Society, annual meeting, The Homestead, Hot Springs, Va.

Oct. 31-Nov. 2—Industrial Management Society, time and motion study and management clinic, Hotel Sherman, Chicago.

Nov. 8-9—All-Canadian Foundry Conference, sponsored by Eastern Canada, Ontario and British Columbia chapters of AFS, Sheraton-Mount Royal Hotel, Montreal.

Nov. 25-30—American Society of Mechanical Engineers, annual meeting, Hotel Statler, New York.

Nov. 26-30—Third International Automation Exposition, New York Trade Show Bldg., New York.

Nov. 29-30—Michigan Regional Foundry Conference, Union Bldg., University of Michigan, Ann Arbor, Mich.

Dec. 5-7—American Institute of Mining and Metallurgical Engineers, electric furnace steel conference, Morrison Hotel, Chicago.

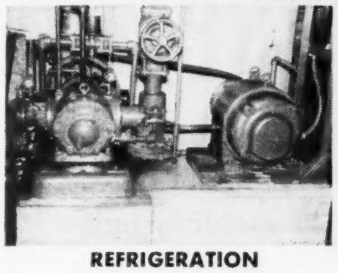
1957

Feb. 14-15—Wisconsin Regional Foundry Conference, Hotel Schroeder, Milwaukee.

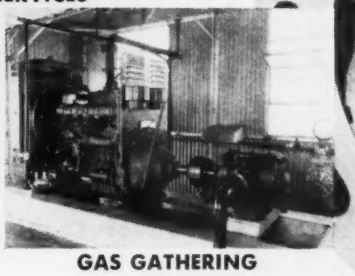
Mar. 25-29—American Society for Metals, Western Metals Congress and Exposition, Ambassador Hotel and Pan-Pacific Auditorium, Los Angeles.

May 6-10—American Foundrymen's Society, 61st annual convention, Cincinnati.

PLANT SERVICES



REFRIGERATION



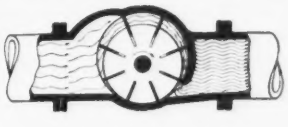
GAS GATHERING

Since 1930

. . . FULLER ROTARY MOTION has been the key to SMOOTHER, MORE EFFICIENT, LOWER COST AIR COMPRESSION

The unique revolving principle pioneered by Fuller is the heart of the Fuller Rotary Compressor—both single- and two-stage types—and provides impressive cost, maintenance and operating advantages.

Simplified Fuller design consists essentially of a rotor eccentrically mounted in a cylinder to form a crescent divided into sections by the rotor blades. Each section or pocket carries air from one end of the crescent to the other without reversal of flow and with measurable improvement in volumetric efficiency. The rotor blades move freely by centrifugal force alone and compensate automatically for wear. As a result, Fuller Rotaries can operate indefinitely without care and the occasional inspection check required can be made with fewer men and in far less time.



Clip, fill in and mail the coupon for detailed information about Fuller Rotary Compressors for plant services, refrigeration or gas gathering.

FULLER COMPANY
148 Bridge St., Catasauqua, Pa.
A SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORP.
Chicago • San Francisco • Los Angeles • Seattle • Kansas City • Birmingham

Fuller
pioneers in harnessing AIR

C-285
3092

COST-SAVING ADVANTAGES

1. Smooth, pulse-free, one-way air flow
2. Almost complete lack of vibration permits use of light foundation
3. Far fewer moving parts insure low maintenance
4. Small size for high capacity permits installation in minimum space
5. Direct drive further reduces space requirements
6. Valveless design permits continuous, unsupervised operation and greatly reduces maintenance

Fuller Rotary Compressors:

- Maintain original capacity for the life of the machine
- Provide a high degree of reliability, thereby reducing standby capacity requirements
- Have few moving parts, thus sharply reducing parts inventory
- Require minimum supervision and inspection

It will pay you to compare Fuller Rotaries with other compressors and evaluate Fuller advantages to your operation in terms of annual net savings. Fuller Rotaries are available for industrial pressures to 125 psig and capacities to 3300 cfm. We will be glad to supply you with facts based on actual experience with Fuller installations over the past 25 years.

FULLER COMPANY
148 Bridge St., Catasauqua, Pa.

Please send me, without obligation, descriptive literature on the Fuller Rotary Compressor. I am specifically interested in a pressure of _____psig and a capacity of _____cfm, to be used for:

NAME_____ ☐ Plant Services
TITLE_____ ☐ Refrigeration
CO. NAME_____ ☐ Gas Gathering
STREET ADDRESS_____
CITY_____ ZONE____ STATE_____

(Advertisement)

An Important Message to Foundry Executives

Competition and the Seven

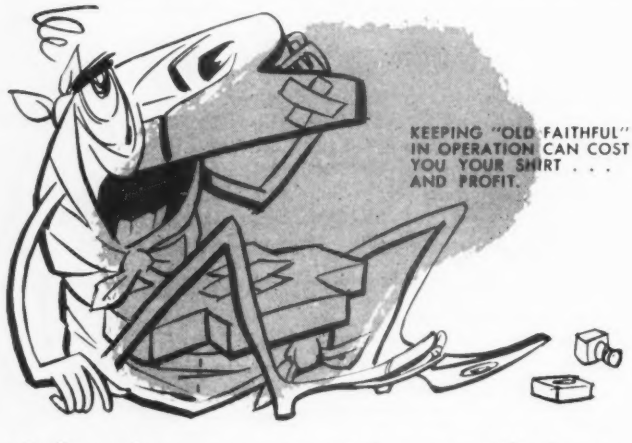
The *Law of Diminishing Returns* is becoming a curse in foundries of all types. Chief cause is the greatly accelerated rate of obsolescence in molding machines . . . and *time* is the key factor.

Seven years is a *relative* increment of time. Its significance varies with the subject concerned. A child of seven is only a youngster, still fourteen years short of maturity. A dog is pushing the averages at seven. And a foundry molding machine that is seven years old or older . . . no matter how well it has been maintained . . . is *economically* obsolete.

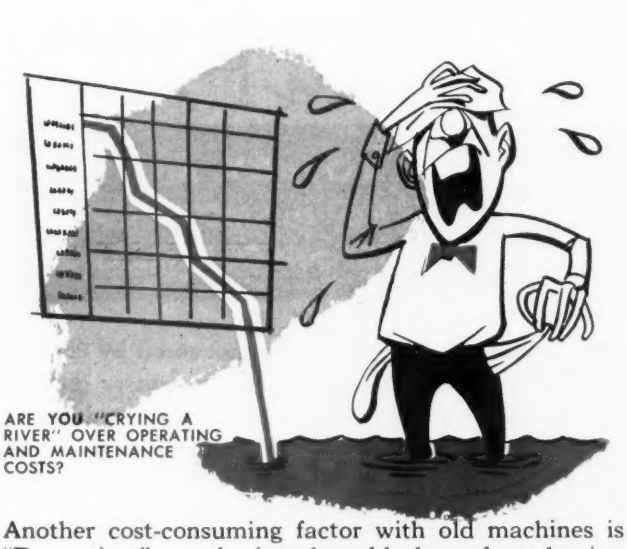
Other types of machinery still are in their prime at age seven. Why is the molding machine an exception? The answer is simple. Its environment as well as its function are unfavorable to longevity.

The abrasive action of sand is an accepted evil in molding operations. Every foundry has experienced profit-cutting "replacement costs", even with the best equipment. What many foundry executives overlook, however, is the fact that *replacement parts do not make a new machine.* They can bring a machine back to its *own* standard, but they cannot compensate for new production techniques or for basic improvements in molding machine design.

Admittedly, it is cheaper . . . in the short run . . . to replace parts than to purchase new machines. But what are the long-range aspects of this practice? If



rebuilt equipment cannot match a competitor's new equipment in capacity or economy of operation, how can a foundry using old machines meet competitive price and delivery schedules and still show a reasonable profit? This is not a rhetorical question. It keeps many foundry executives awake nights.


ARE YOU "CRYING A RIVER" OVER OPERATING AND MAINTENANCE COSTS?

Another cost-consuming factor with old machines is "Down-time" . . . the irreplaceable loss of production capacity. The older a machine is, the more maintenance it requires, the greater the periodic down-time. *Unfortunately, "overhead costs" never stop for replacement.*

Consider your foundry's situation for a moment. Can you meet or beat your major competitors' price, quality and delivery? If you can, you are most fortunate. But . . . let's suppose you *are* at a competitive disadvantage. How long can you stay in that position and survive?

In industry, as in war, there are "the quick" and "the dead". The former keep pace with industry trends and changes . . . know when and how to improve operations and maintain their favorable position. These aggressive men also follow the policy of continual investment in new equipment.

The "dead" try to stand still in a moving current. They practice short-range economies and philosophies. And eventually they drown in the steadily rising river of competition.

The foundry economy is in a dramatic state of flux. A major factor is the growth of *automation* . . . a science with exciting, almost magical, overtones but with an extremely practical foundation. Automation is the large company's answer to shrinking profits as well as to greater production capacity of uniform standard. It is not, however, economically feasible for the majority

(Advertisement)

Concerning . . .

Year Curse

of jobbing or production foundries. In most cases, automated operations involve a far-greater-than-average capital expenditure.

This message is directed therefore to foundrymen who want to achieve greater efficiency and profits at relatively low cost. The answer here also is simple. *Invest in new high-speed semi-automatic equipment.* Relegate your seven year old molding machines to odd jobs. Or put them on the used machinery market. (There still are many who cannot see the "wolf at the door".)

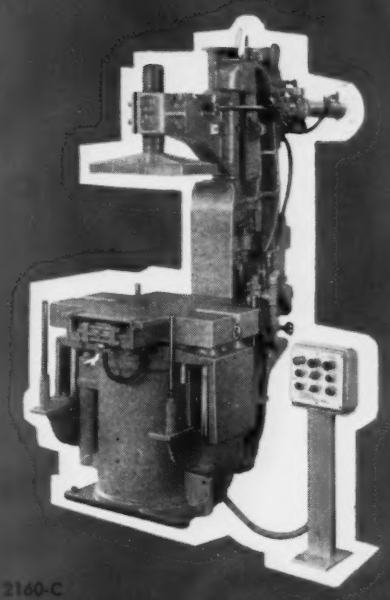
Once you have made this decision, select your new molding equipment carefully. But remember that old buying habits, like old machines, can cost you more in the long run.

EFFICIENT NEW EQUIPMENT GIVES YOU A COMPETITIVE ADVANTAGE IN PRICE, QUALITY, DELIVERY.

Your best bet is to select equipment made by the manufacturer who leads the industry in Creative Engineering . . . SPO Incorporated. Technological innovations developed by this company since World War II have had a profound effect on the foundry industry.

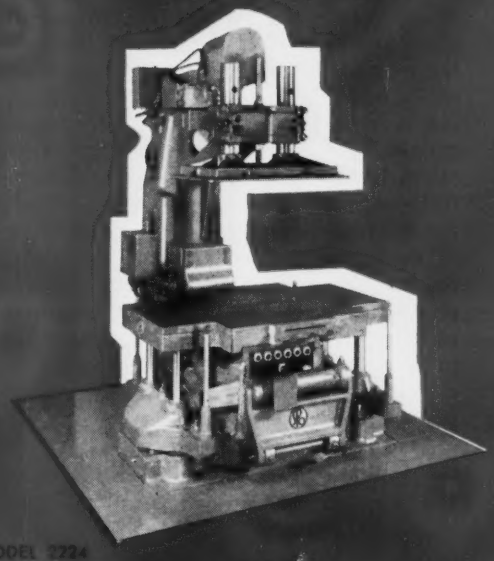
SPO "firsts" include development of the maintenance-free inverted jolt mechanism . . . the fully automatic SPOMATIC molding system and its components . . . the first practical hollow core machine . . . the self-aligning stripping mechanism . . . and the first successful application of green sand cores.

These accomplishments have established SPO as the leader in molding machine and ancillary equipment development. That is why SPO has become the world's largest supplier of molding machines, offering a complete range of types and sizes. SPO INCORPORATED, 6449 Grand Division Avenue, Cleveland 25, Ohio



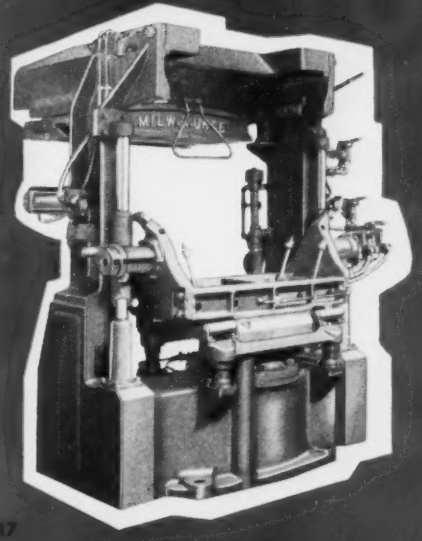
MODEL 2160-C

Series 2000-C **jolt-squeeze-strip/draw** machines feature automatic controls and simplified pushbutton operation. Available with squeeze cylinder diameters of 13, 14 and 16 inches.



MODEL 2224

Featuring patented "inverted jolt" mechanism, this semi-automatic Series 2000 **jolt-squeeze-strip** machine handles wide range of flask sizes. Seven models available with jolt capacities from 1500 to 4000 pounds.



MODEL 217

This SPO-MILWAUKEE **jolt-squeeze-rollover-draw** machine combines all operations in simplest possible cycle for fast production of drag molds. Three models available (16, 21 and 30-inch squeeze pistons).

Another foundry handles it with Whiting!

Peak Efficiency Attained In Make-up and Charging!

A large automotive foundry recently expanded operations to meet increasing casting demands. Included in this expansion were various types of equipment to unload and store incoming raw materials, to make up charges, and to charge six new Whiting cupolas.

Here is how the system operates. Coke and stone are brought in by hopper cars which discharge directly into a track hopper. Materials go onto conveyors to skip buckets and the buckets take them up to a belt conveyor that runs the full length of the building in which are the six Whiting cupolas. A motorized belt tripper directs the flow into proper bins. Each cupola has its own coke and stone bin equipped with steam coils to prevent freeze-up. The bins are located directly above batch-weigh hoppers and coke and stone make-up is completely automatic. A selector switch is incorporated so that the system can be manually controlled when weighing up large quantities of coke for the coke bed. Coke breeze is removed by means of a grizzly section in the coke feeder. The system is equipped with sampling gates making it possible for the metallurgist to check the quality of the coke. The breeze is conveyed to a storage bin in the yard and hauled away as refuse.

Pig iron, scrap and alloys are placed in respective bins by the three Whiting 10-ton, 80-ft. span cranes equipped with 65-inch diameter magnets.

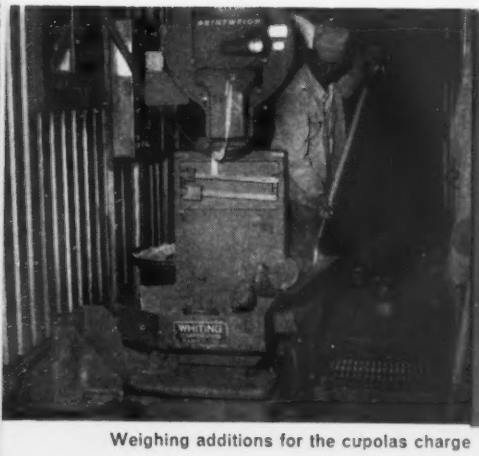
Non-metallic alloys are carried on pallets by a monorail carrier. The alloy additions to the charges are carefully weighed on platform scales before being dropped into the charging buckets.

Each cupola is equipped with a stationary skip charger with a full cone-bottom bucket. The buckets receive the metal charge from 100 cu. ft. capacity batch-weigh hoppers which are equipped with a weight recording scale. The charge is made up by the yard crane operator who also operates the scale printweight mechanism from a push button in the crane cab. After the metal charge has been dropped into the charging bucket, the bucket moves to another position where it receives the coke and stone charge and the alloy additions.

This Whiting system is doing a remarkable job . . . it has made possible the needed increased production with a minimum of manpower and with low operating cost.

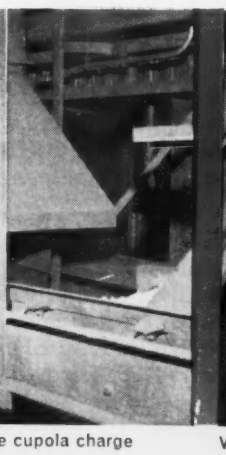
For the complete story of make-up and charging operations at this automotive foundry including melting operations, write for the spring issue of the WHITING FOUNDER. Bulletin FY-153R gives detailed catalog data . . . ask for it also.

WHITING CORPORATION WHITING 15607 Lathrop Ave. Harvey, Ill.



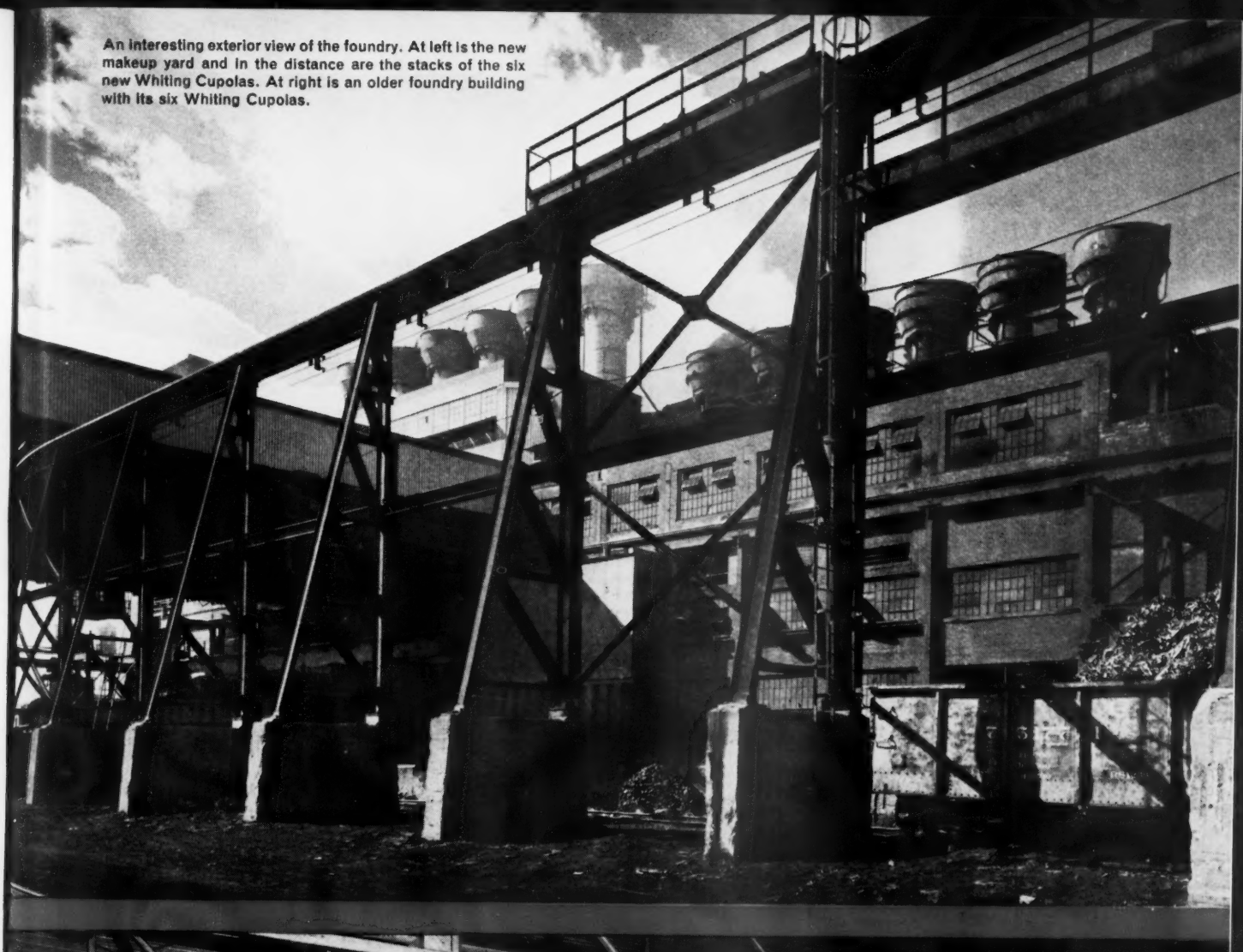
Weighing additions for the cupolas charge

Coke being measured for the cupola charge



Whiting full cone controlled discharge bucket entering cupola stack.

Circle 567 on Inquiry Card—Page 201

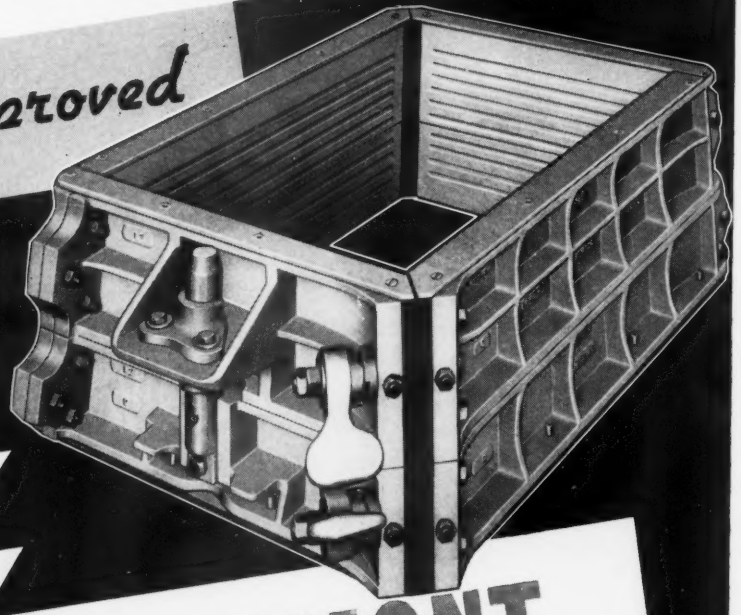


An interesting exterior view of the foundry. At left is the new makeup yard and in the distance are the stacks of the six new Whiting Cupolas. At right is an older foundry building with its six Whiting Cupolas.

A view of the make-up yard showing Whiting Overhead Cranes and various bins.

The FLASK with the NEW STRENGTH BUILT-IN

the new improved



■ New two-piece male and female stop, inserted above and below the stud bolt, result in additional corner strength. Corner gaps completely closed by long-life, easily replaceable, live rubber corner inserts which prevent sand from lodging in corners.

■ Made of magnesium, which has twice the tensile strength of aluminum, with cams of hardened steel forgings, the Spread-lock really resists wear . . . assures long service.

■ Furthermore, magnesium weighs ⅓ less than aluminum, so they are light in weight, easier to handle.

■ The accurately machined inside surfaces and flanges, and steel-faced top and bottom flanges assure most exacting work.

Write today for free literature and prices.

FREMONT SPREADLOCK FLASK

NO OTHER FLASK GIVES YOU ALL THESE ADVANTAGES!

The Fremont FLASK Co.
FREMONT, OHIO

find out how you can bake your cores better, faster more economically **ELECTRONICALLY!** in

This Coleman CD-150 Dielectric Core Oven bakes over 8,000 pounds of urea-bonded pipe fittings cores per hour at Alabama Pipe Company, Anniston, Ala. Total time on conveyor is 11 minutes!

COLEMAN *Dielectric* OVENS

Which is better for you . . . dielectric or recirculating air core ovens?

As builders of the world's only complete line of foundry ovens, only Coleman Oven Engineers can give you practical, unbiased recommendations for your particular application.

The foundries pictured are typical users of Coleman Dielectric Core Ovens. These ovens were installed after a thorough study by Coleman Oven Engineers indicated that dielectric core baking would be the most economical method in each case.

Because of this approach, based on over half a century of foundry "know how" combined with the latest electronic technology, every Coleman Dielectric Core Oven installation has been extremely profitable. Important savings have been made in time . . . in manpower . . . and through increased production.

Consult a Coleman Oven Engineer. There is no obligation. As builders of the world's only complete line of foundry ovens we have no reason to recommend anything but the best oven for your needs . . . We build them all.

WRITE FOR BULLETIN 54.

The Deming Co., Salem, Ohio, uses their Coleman CD-25 Dielectric Core Oven to bake a wide variety of phenol-bonded cores for cast iron and brass pump castings.

Hills-McCanna Company, Chicago, Ill. bakes 1500-1700 pounds of cores per hour for magnesium aircraft engine castings in their Coleman CD-25 Dielectric Core Oven.

A COMPLETE RANGE OF TYPES AND SIZES . . .
for every core baking and mold drying requirement:

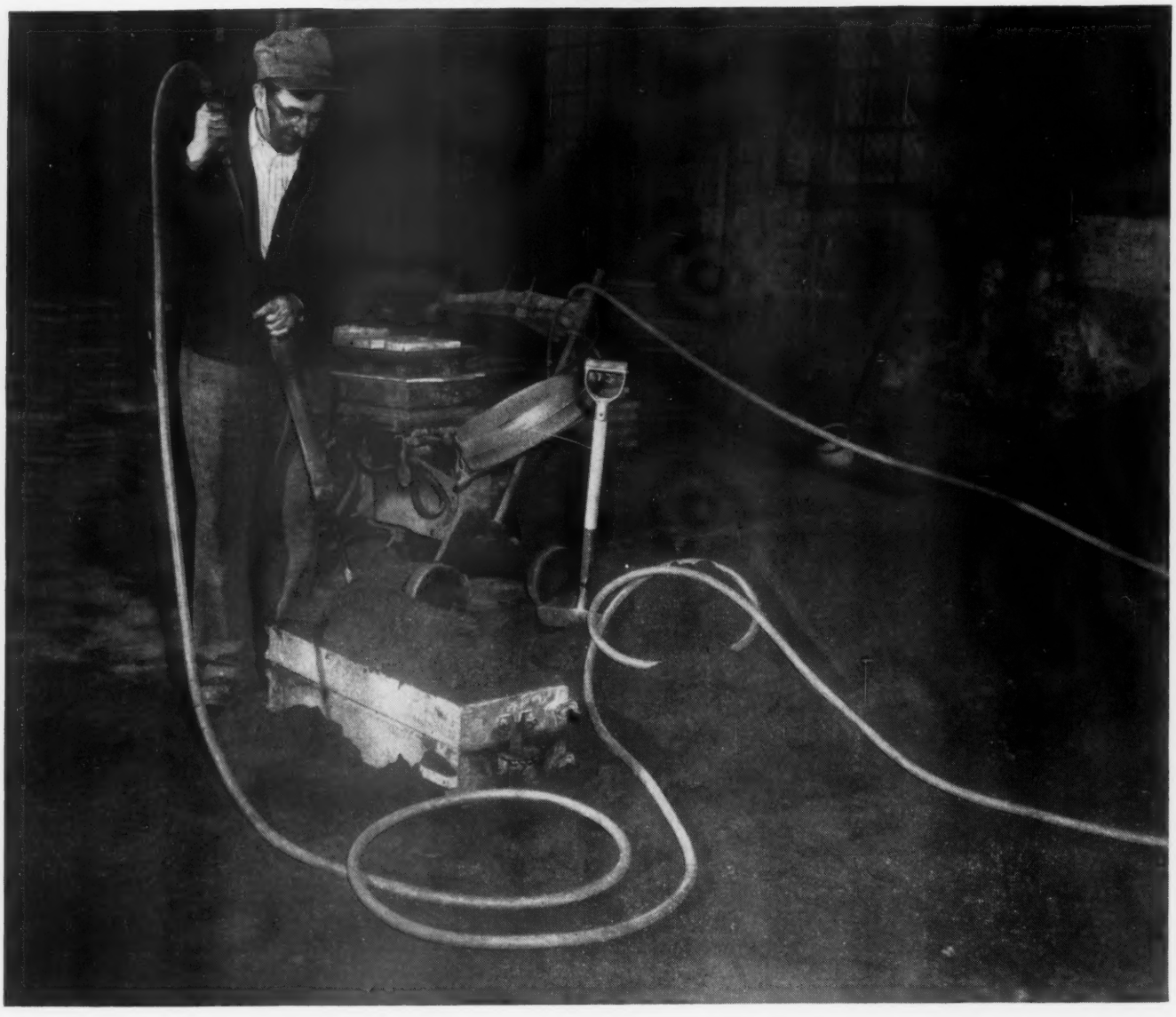
Tower Ovens • Horizontal Conveyor Ovens
Car-Type Core Ovens • Car-Type Mold Ovens
Transrack Ovens • Rolling Drawer Ovens
Portable Core Ovens • Portable Mold Dryers
Dielectric Core Ovens

THE FOUNDRY EQUIPMENT COMPANY
1821 COLUMBUS ROAD **CLEVELAND 13, OHIO**

WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS

MEMBER FEMA

B.F.Goodrich



Hose lasts for years in heat, oil, hard knocks

B. F. Goodrich Type 50 handles 85% of all air hose jobs

IN foundry service, the hose on small air tampers used to last only a few months. Sometimes the hose would be crushed by falling materials. Or the hot air would harden the rubber, causing it to crack.

B. F. Goodrich engineers went to work on the problem, and came up with improvements in air hose, using new rubber compounds for both tube and cover. This improved B. F. Goodrich hose was in its fifth year service when the picture shown here was taken, still good for many more years.

Rough treatment won't tear it

In foundry service, air hose is often dragged over rough, gritty surfaces. So B. F. Goodrich makes Type 50 hose with a tough, non-peeling oilproof cover. It stands rough treatment and has high resistance to tearing, cutting, gouging and abrasion.

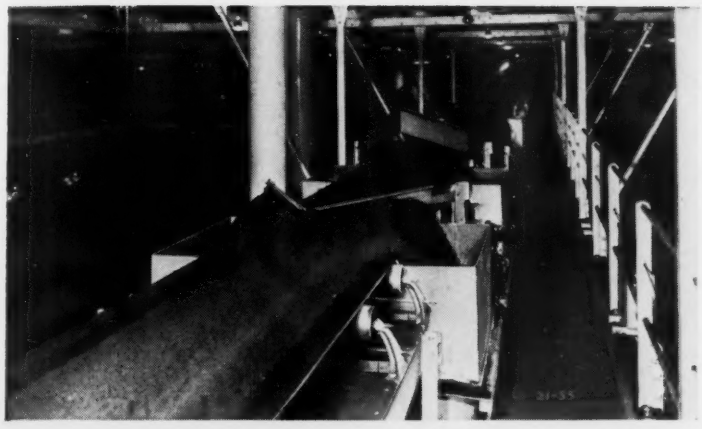
Heat won't crack it

Special rubber lining in Type 50 air hose withstands hot air, won't harden and crack, nor will it break into loose, gummy particles to clog tools.

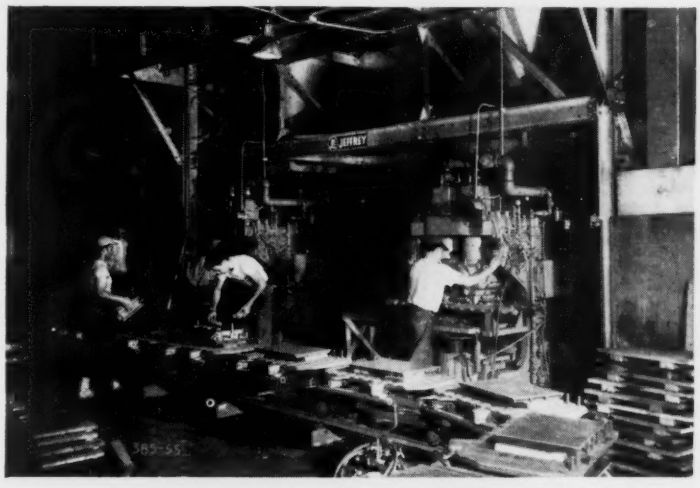
Before you buy another length of air hose, check first with your B. F. Goodrich distributor. Chances are Type 50 will be the right hose for your job because it handles 85% of all air hose needs. *B. F. Goodrich Industrial Products Company, Dept. M-711, Akron 18, Ohio.*

B.F.Goodrich

INDUSTRIAL PRODUCTS



Jeffrey Sand Handling Belt Conveyor with Automatic Plows



Jeffrey Universal Mold Conveyor

Jeffrey Universal Mold Conveyor, Automatic Mold Dumper and Apron Conveyor

Jeffrey Apron Conveyor Handling Castings

you'll see the difference in foundries planned by JEFFREY

MECHANIZATION takes over many operations formerly requiring manpower—from sand preparation and distribution to the molders and core makers, to the pouring positions and shakeouts, then back to sand reclaiming and storage—moving raw materials and processing finished castings. Jeffrey services to the foundry industry are that complete.

We'll start with a survey, prepare layouts and recommend equipment, build and install a system to suit your exact requirements. We'll alter existing facilities or replace obsolete units with modern, efficient Jeffrey machinery.

Catalog 845 describes these services and equipment. For a copy, write to The Jeffrey Manufacturing Company, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

Circle 571 on Inquiry Card—Page 201

One of BERYLCO'S 3000-lb. molten metal Detroit Electric Furnaces lined with TAYCOR refractories. Photo shows test sample being taken of a beryllium-cobalt-copper alloy.

Comparative tests at **BERYLCO**®

show TAYCOR gives 40% longer lining life

in their Detroit Electric Furnaces

The Beryllium Corporation, Reading, Pa., world's largest integrated producer of beryllium-copper alloys, gives credit to TAYCOR (corundum-base) refractories for a 40% increase in the lining life of their Detroit Electric Furnaces.

Four 3000-lb. furnaces are operated. Three are on the job 24 hours a day (the fourth is operated 16 hours a day), six days a week, melting 10 to 12 2000-lb. heats at temperatures of 2100° to 2900° F. All of the furnaces are lined with TAYCOR. Lining life averages 900-1000 heats, ranging from 1,800,000 to 2,000,000 lbs. . . . 40% longer hard-use life than obtained from a wide variety of other refractory materials formerly used.

TAYCOR performance reports, such as this one by The Beryllium Corporation, are duplicated by many furnace operators across the nation, melting high-nickel alloys, low-carbon steel, molybdenum-tungsten steel, Ni-hard, as well as beryllium copper. Put TAYCOR to the test in your furnaces.

Exclusive Agents in Canada:
REFRACTORIES ENGINEERING AND SUPPLIES, LTD.
Hamilton and Montreal

TAYLOR ZIRCON · TAYLOR SILLIMANITE

The **CHAS. TAYLOR SONS Co.**
A SUBSIDIARY OF NATIONAL LEAD COMPANY

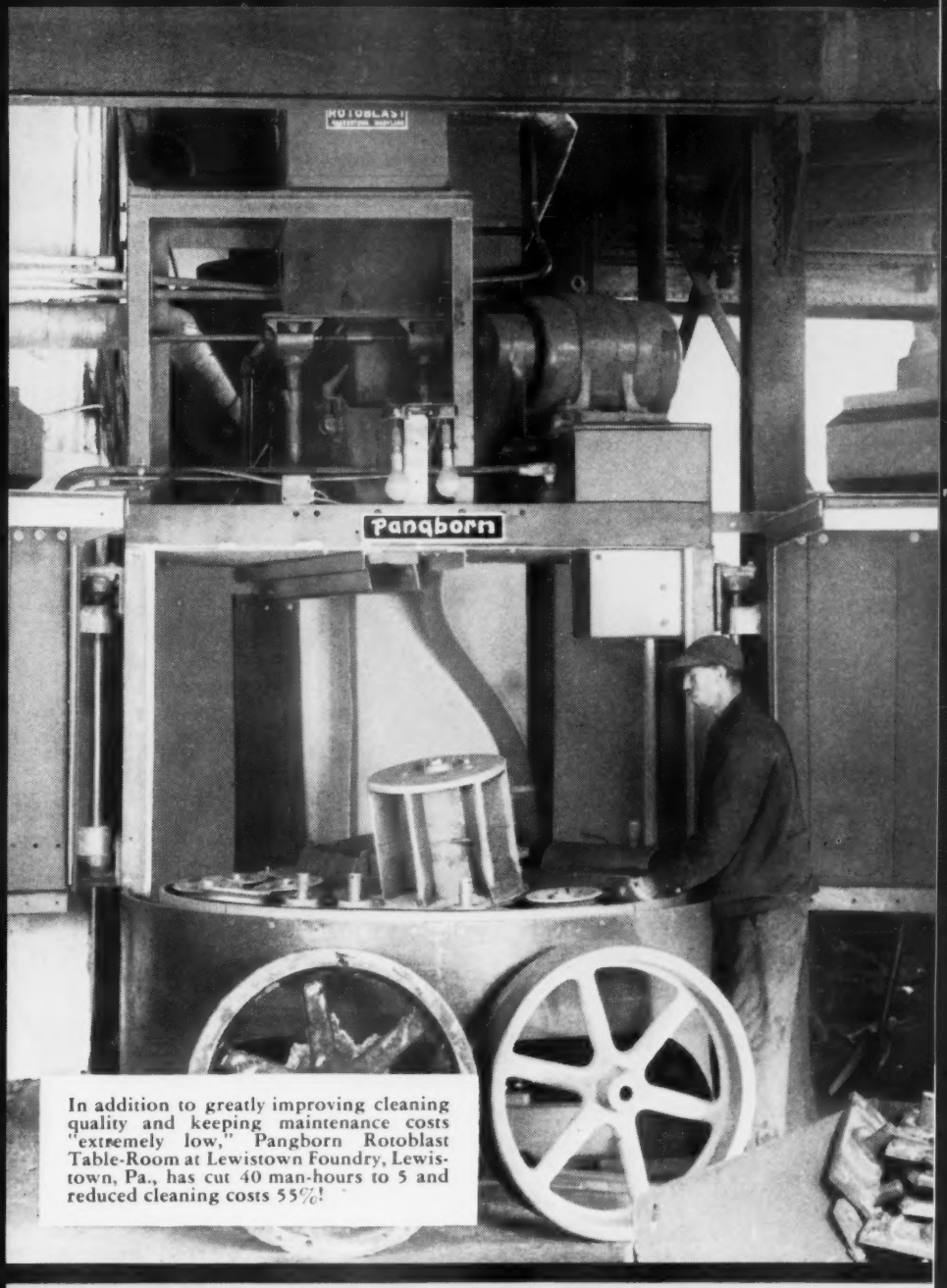
REFRACTORIES SINCE 1864 • CINCINNATI • OHIO • U.S.A.

Pangborn Rotoblast® reduces cleaning costs 55% at Lewistown Foundry!

One foundry says it "cuts labor costs." Another says it "reduces maintenance." A third says, "speeds production." Foundries that blast clean with Pangborn Rotoblast equipment can offer different reasons —and combinations of them—for Rotoblast's cost-cutting operation.

They all add up to one thing—*lowest cost per ton of castings cleaned!* That's because Pangborn Rotoblast cleans thoroughly, quickly, automatically. You get a finer, uniform finish on your jobs; power and labor costs go down; maintenance costs drop; production goes up.

Check your present cost per ton and then find out how Pangborn can *slash* your cleaning costs. Write for Bulletin 227 to PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Blast Cleaning and Dust Control Equipment.*



In addition to greatly improving cleaning quality and keeping maintenance costs "extremely low," Pangborn Rotoblast Table-Room at Lewistown Foundry, Lewistown, Pa., has cut 40 man-hours to 5 and reduced cleaning costs 55%!

And cuts labor costs in half at Keen!

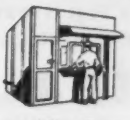
Pangborn Rotoblast Table and Rotoblast Barrel at Keen Foundry, Griffith, Ind., clean *three times faster* than previous equipment, cut cleaning room labor costs 50%!

Pangborn

BLAST CLEANS CHEAPER

Rotoblast Blastmaster® & Continuous-Flo Barrel

Rotoblast® Tables & Table-Rooms


Special Blast Rooms & Cabinets

Pangborn Dust Control Equipment

Distributors for Malleabrasive and Tru-Steel Abrasives

Circle 573 on Inquiry Card—Page 201

For Lower Cost Handling...

OVER 100 ELPAR MODELS

With more than 100 models in all types—fork lift, low lift, high lift platform, crane—Elwell-Parker has the *right* truck to do *your* toughest handling jobs at lowest cost. Here's why:

- ELPAR quiet, fume-free electric trucks cost only pennies per day to operate.
- Packaged unit design means instant accessibility for preventive servicing.
- Extra reinforcement of critical parts prevents excess wear and breakdowns.

Elwell-Parker built the first electric industrial truck 50 years ago and has since pioneered many major advancements. Over 90% of ELPAR trucks made since 1925 are still in service—good reason why 75% of the nation's leading manufacturers use ELPAR trucks.

GET THE FULL STORY—
WRITE FOR FREE CATALOG

THE ELWELL-PARKER ELECTRIC CO.

4315 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

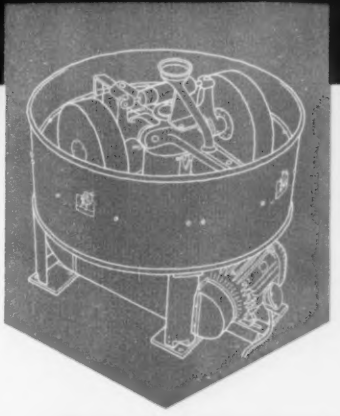
THIS IS THE PENNY

per ton in maintenance that it cost Elyria Foundry Division to run these TWO MIX-MULLERS for a 3½ year period.

The shops that these two 3F Mix-Mullers service pour castings that range from 500 to 100,000 lbs. for the Elyria Foundry Division of Industrial Brownhoist Co., Elyria, Ohio. In the 3½ years since installation they have turned out an impressive 425,000 lbs. of core and backing sand on an 8 and 16 hour a day schedule respectively. They've done it on *pennies per ton* too.

In maintenance these mix-mullers have cost Elyria Foundry Division *one cent per ton* of sand prepared over 3½ years. Including power, the total operating cost figures out at about 4.6 cents per ton. There has been *no* mixer down time in that period. Based on original investment, maintenance, not per year, *but for 3½ years*, has been less than 1%.

It's an impressive record and is in part due to the excellent systematic preventive maintenance program operated by Elyria Foundry Division. But it's typical too of the kind of rugged efficiency which is saving maintenance dollars for Simpson Mix-Muller users the world over.



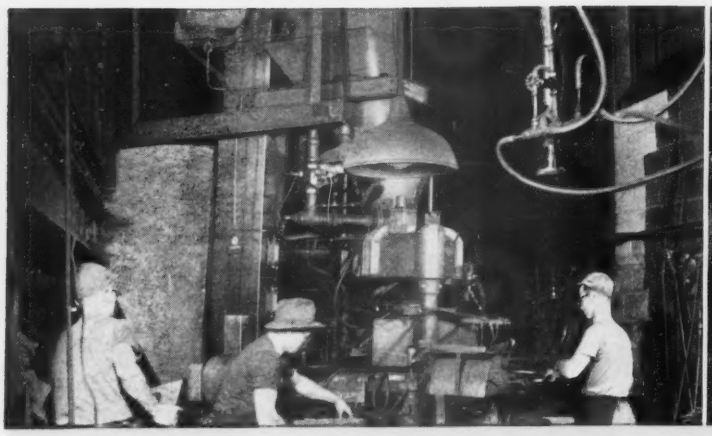
A MODEL 2F MIX-MULLER will soon replace the last of Elyria Foundry Division's other mixers to provide them with one of the most modern high capacity sand preparing facilities in the area—all mix-muller equipped!

NATIONAL Engineering Company

646 MACHINERY HALL BLDG. • CHICAGO 6, ILLINOIS

SIMPSON MIX-MULLERS • NATIONAL SCREEN MASTER • NATIONAL SAND RECOVERY SYSTEM • SHELL-MULL • NATIONAL MOLDER'S HELI

Circle 575 on Inquiry Card—Page 201



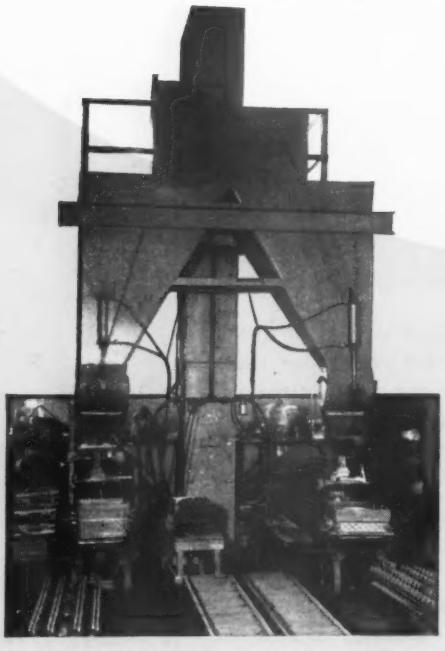
LAKEY FOUNDRY AND MACHINE CO., Muskegon, Mich., is using standard Handy Sandys in conjunction with Rotary Core Blowers to help jump production of cores from 350 to 2500 daily. Production per man has more than doubled since the Newaygo units were installed. To meet the space problem in the core room, Newaygo developed special storage hoppers, wing boards and special feed hoppers.

Each Handy Sandy is capable of feeding over 8 tons of core sand per hour to each core blowing unit. The cores average from 14 to 50 lbs. each.

GENERAL ELECTRIC COMPANY'S Malleable Iron Foundry in Erie, Pa., is using two Twin Hopper Handy Sandys to replace six floor molding units making malleable castings for locomotive and car equipment. The General Electric Company is very well pleased with the performance of this Newaygo Equipment and has reported maintenance costs to be extremely low.

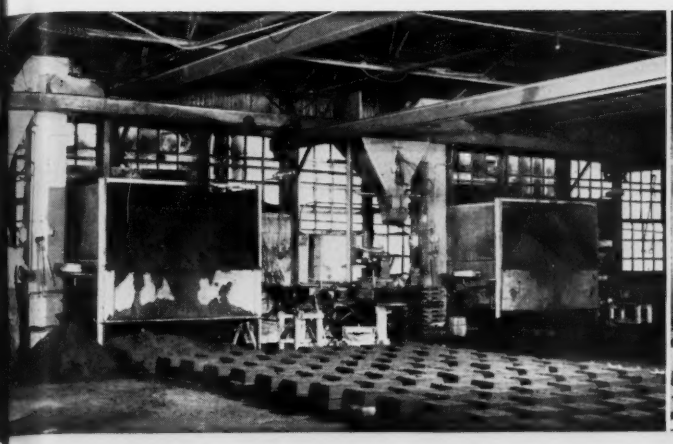
Foundry Business is BIG

and profitable with NEWAYGO *mold and conditioning*



SUPER HANDY SANDY in a prominent eastern foundry has shown tremendous savings. In one installation this low-cost individual floor sand handling unit increased mold production on large molds 150% due to savings in shovel time alone. Super Handy Sandys are available with single or double hoppers for supplying one or two molding stations and can handle up to 50 tons of sand per hour.

PACIFIC STEEL CASTINGS COMPANY, Berkeley, Cal., is another example of a Newaygo installed Sand Handling system. "The excellent cooperation which we received from the planning stage to the completion of the installation is a real service to any company which is considering the installation of a sand handling system," states Mr. J. D. Genger, Vice President in charge of operations at this foundry.



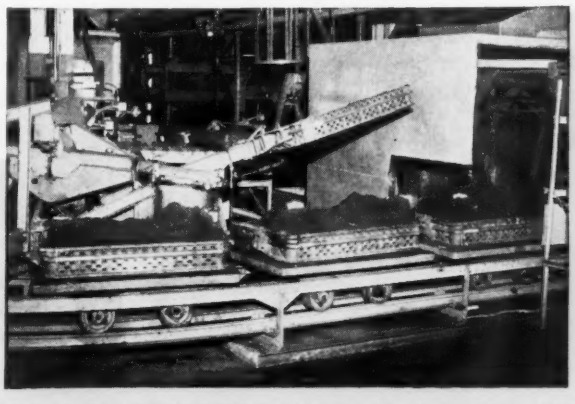
Mr. Lou Keen, President of KEEN FOUNDRY CO., Griffith, Indiana, states: "We've invested in 10 Newaygo Handy Sandys in less than 3 years for several reasons. First, these individual Sand Handling Units are very adaptable to the physical characteristics of our foundry. Second, their great flexibility gives us overhead sand stations at any point in the foundry without costly remodeling. Third, Handy Sandys require low capital investment."

AUBURN FOUNDRY, INC., Auburn, Indiana, "When our foundry 'threw out the shovel' in favor of mechanization, we picked Newaygo to work with us because of their experience in engineering and fabricating sand handling systems. With the 120 ton Sand System, increases in casting production, improved pouroff and sand handling have been very evident."

Business...

handling, sandhandling equipment

UNITED STATES FOUNDRY CORPORATION, Milwaukee, Wis. "Newaygo Handy Sandys and Reddy Sandys combine their automatic features to eliminate all shoveling from the shakeout, sand preparation and molding cycle. Their installation has made a vast improvement in working conditions and has increased over-all production 35%."



CENTRAL SPECIALTY DIVISION, Ypsilanti, Michigan, "This is the fifth sand handling system Newaygo has installed for us. On this particular job we wanted engineering ability, heavy duty specifications plus follow-through and attention to job details. Newaygo filled these requirements. This extremely compact automatic molding system is contained in an area 165' by 50' and is shaping up very successfully."

View from the pouring floor of a large midwest steel foundry showing specially designed molding hoppers of Stainclad Steel with air operated gates. Also shown is the mold storage end of the Platen Car set-out track system. Molds are handled on pallet cars and are automatically dumped at end of lines into a vibrating pan conveyor. Pallet Cars and boards are automatically returned on an underneath track system.

A Copy of "Planned Mechanization for Foundries" is yours for the asking. Write, wire or phone today.

NEWAYGO engineering company
NEWAYGO, MICHIGAN

Manufacturers of Neway® Mold Handling, Sand Handling and Conditioning Equipment

synthetic resins

CO_2 sand (WITH CORRECT PERMEABILITY)

facing sand (FOR GREEN TOPPING CORES)

oil sand

pitch and cereal

with working moistures ranging up to 8% and proper green bond strength for individual requirements...

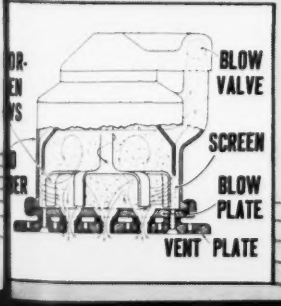
all are being blown on SAN-BLO machines

Manufactured by *San-Blo Division*

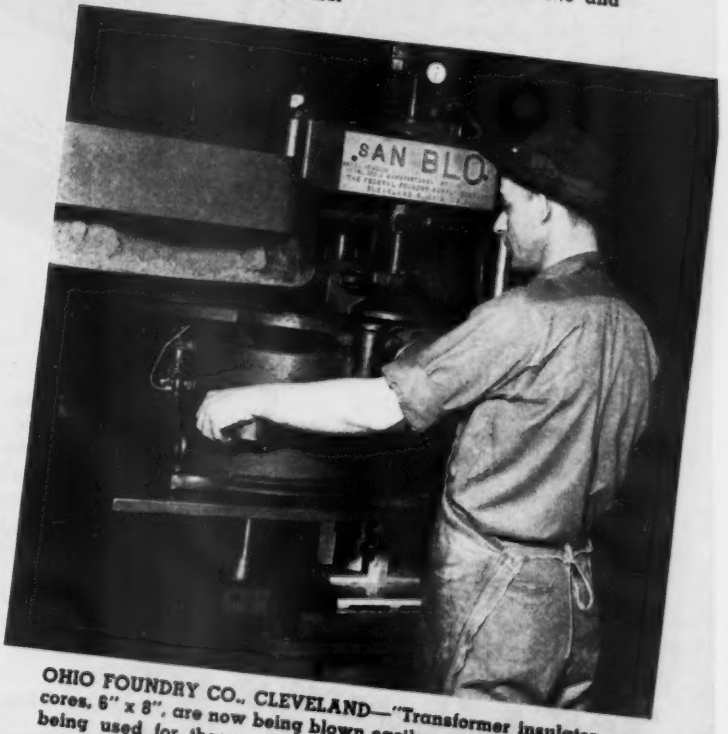
ATLANTIC FOUNDRY CO., AKRON—"Core mixture, for sprocket cores being blown on our San-Blo, tests 5.5% moisture, 3.7 lbs. green strength, and 60 permeability. We also found we could blow our runner cups."

WEHR STEEL CO., MILWAUKEE—"We found we could blow the following three mixes: 3% Woodflour Mix, 4% Dry Binder Mix and 30% Silica Flour Mix. Moisture from 4 to 7% and green strength from 3 to 7 lbs."

The SAN-BLO can blow these non-flowable core mixtures because motor-driven plows in its blow head move sand mechanically to the blow hole. Air is used only to aerate sand in the lower part of the blow head and convey it into the core box. Follow the green arrows and you'll see how air enters the blow head, fluffs up the sand as the plows move it toward the blow hole, and finally picks up the sand, at full pressure, to carry it quickly into the core box.



You, too, can blow non-flowable mixtures, but only with a SAN-BLO!



OHIO FOUNDRY CO., CLEVELAND—"Transformer insulator cores, 6" x 8", are now being blown easily and rapidly. Sand being used for these cores tests 8% moisture and 6 lbs. green bond strength."

The **FEDERAL FOUNDRY SUPPLY** *Company*

4600 EAST 71st STREET, CLEVELAND 5, OHIO

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION MEMBER FEMA

cedar heights

AIRFLOATED CLAY

ground extra fine 200 mesh

request a complimentary sample today and see for yourself.

FROM THE WORLD'S FINEST CLAY DEPOSITS

We start with carefully selected clays mined in the Ohio hills. Then this unmatched clay is artificially dried and ground exceptionally fine. The result is something new in the industry — a superior bonding clay with a vast range of applications.

Yes, it's actually refined to 200 mesh. Pioneered by Cedar Heights Clay Co and available everyday in the year to foundry men everywhere. Ask your distributor

CEDAR HEIGHTS CLAY COMPANY

50 PORTSMOUTH ROAD OAK HILL, OHIO

Late News

July 27, 1956

PIG IRON UP: Increases of from $1.25 to $4 a ton have been made in the price of foundry grades of pig iron in various sections of the country. In most areas where advances have been announced the boost is $2.50. At Everett, Mass., the rise was $1.25; at Birmingham it was $4. Higher labor costs are a factor in the increases. Early resumption of steelmaking will help support the recent upturn in scrap prices.

NEW FOUNDRIES: Construction of a $10 million plant for the casting of mill grinding balls is being considered by National Malleable & Steel Castings Co. Employing 200 to 300, the foundry would be built in the Duluth-Superior area of Minnesota. National now operates a similar plant near Phoenix, Ariz.

American Radiator & Standard Sanitary Corp. is starting work on a new $3½ million gray iron foundry in Louisville. Producing enamelware, it will replace some old facilities.

AIRCRAFT CASTINGS: A program to establish acceptability and manufacturing techniques for use of castings—particularly steel castings—in aircraft is recommended in a report prepared at the request of the Department of Defense. The report, made by a panel of representatives from aircraft, steel casting and research industries, suggested government expenditures of up to $1,250,000 annually for several years to carry out the program. The panel said present study is "insufficient and unco-ordinated." It also called for basic investigations into foundry controls, mold materials and castings alloys.

ALUMINUM CLIMBS: Production of primary aluminum in the first half this year set a record at 860,000 tons, according to the Aluminum Association. This was 13 per cent ahead of the 1955 period. With capacity expanded more than 100,000 tons since January, this year's total output appears likely to reach a new high.

NICKEL CONTROL: Nickel alloys—in various forms, including castings—have been added to the list of controlled materials regulated by the Defense Materials System. Under this new order, issued by the Business and Defense Services Administration, defense contractors will obtain preferential deliveries of nickel alloys the same way as they now obtain deliveries of nickel-bearing stainless steel—either by allotment or by self-authorization. This order applies only to defense-rated business; it will in no way affect the distribution of nickel alloys in the civilian market.

EXECUTIVE RESERVE: BDSA is starting to build up its National Defense Executive Reserve. It consists of industrialists who have agreed to serve the government in any mobilization emergency. Several hundred men already have accepted invitations to join the group. Among those certified to date for security classification are: Clyde M. Adams, Bohn Aluminum & Brass Corp., Detroit; Harold G. Erskine, Aluminum Co. of America, Pittsburgh; Bradley B. Evans, Empire Steel Castings Inc., Reading, Pa.; Everett G. Fahlman, the Permold Co., Medina, O.; Thomas Kaveny Jr., Herman Pneumatic Machine Co., Pittsburgh; Harold Larsen and Alfred R. Trinkle, International Nickel Co., New York.

HANDLING BOOMS: Bookings of material handling equipment manufacturers are running well ahead of the 1955 pace. Sales index of the Material Handling Institute through May averaged 143.78, compared with 121.46 for the average of all of 1955. The May index was 155.5.

ACQUIRES FOUNDRY: Humphryes Mfg. Co., Mansfield, O., manufacturer of gray iron sanitary ware is being merged with the Borg-Warner Corp. It will be operated as the Ingersoll-Humphryes Division of Borg-Warner. Present management will be retained, with D. J. Jones continuing as president.

OBITUARY: Robert E. Belt, 74, for 30 years secretary-treasurer, Malleable Founders' Society, died July 25. He retired in 1946 . . . Dr. Oscar E. Harder, retired assistant director of Battelle Memorial Institute, Columbus, O.,

died July 10 . . . Chester H. Kimmel, 53, president, Ohio Crankshaft Co., Cleveland, died July 12 . . . Reginald Drant, 66, a co-organizer of Sorbo-Mat Process Engineers, Clayton, Mo., died in St. Louis, July 13 . . . William H. Sayre, 57, president, American Abrasive Metals Co., Irvington, N. J., died June 29 . . . William J. Hall, 73, former works manager, Fahralloy Canada Ltd., Orillia, Ont., died July 4 . . . Karl Grobschmidt, 57, general superintendent, Badger Malleable & Mfg. Co., Milwaukee, died July 2 . . . William F. Muth, 68, retired vice president, National Bronze & Aluminum Foundry Co., Cleveland, died July 20 . . . H. R. Simonds, chairman, Simonds Worden White Co., Dayton, died July 6 . . . Gerald Frink, president and general manager, Washington Iron Works, Seattle, died July 10.

CARBUILDING: Freight car builders whittled their heavy backlogs slightly in June as deliveries totaled 5550 cars and new orders were received for 2859. Total on order July 1 was 129,409, against 27,102 a year ago. The steel strike hurt operations at some shops.

PERSONALS: Richard A. McBride has been made executive vice president and general manager and Richard W. Krieg has been made vice president in charge of sales, Crucible Steel Casting Co., Milwaukee . . . David Matter has been appointed manager of iron foundry service, Ohio Ferro-Alloys Corp., Canton, O. He was formerly research metallurgist with International Harvester Co.

MISCELLANY: Allis-Chalmers says it was granted patents June 12 on its process for producing nodular iron. It uses magnesium chloride and sodium chloride to nodularize the graphite . . . Austenal Laboratories Inc., New York, investment casting producer, has changed its name to Austenal Inc. . . . Dow Chemical Co.'s magnesium foundry at Bay City, Mich., recently completed 2 million manhours of work without a lost-time injury. For the last five years the foundry's safety record has been ten times better than the industry average . . . A. P. Green Fire Brick Co. has acquired the Pyro Refractories Co., Oak Hill, O., the Durex Refractories Co., Jackson, O., and the Portsmouth Clay Refractories Co., South Webster, O. . . . Superior Brass & Aluminum Casting Co., Lansing, Mich., has been sold to W. W. Edwards and C. C. Sigerfoos.

Prices of Foundry Metals and Coke

(As of July 27, 1956)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE	
Connellsville	$16.00-17.00
OVEN	
Birmingham	$25.65
Buffalo	27.50
Detroit	27.50
Erie, Pa.	27.50
Indianapolis	26.75
Kearny, N. J.	26.75
Lone Star, Tex.	19.50
Milwaukee	27.50
Montreal, Que.	28.50
Neville Island (Pittsburgh)	26.25
New England, deld.	28.55
Painesville, O.	27.50
Philadelphia	26.50
St. Louis	28.50
St. Paul	26.50
Swedeland, Pa.	26.50
Terre Haute, Ind.	26.75

PIG IRON

(Per gross ton f.o.b. furnace)

	No. 2 Foundry	Malleable
Birdsboro, Pa.	$65.00	$65.50
Birmingham	59.00	63.00
Buffalo	60.50	61.00
Chicago	63.00	63.00
Cleveland	60.50	60.50
Duluth	63.00	63.00
Erie, Pa.	63.00	63.00
Everett, Mass.	63.75	64.25
Fontana, Calif.	70.50	....
Geneva, Utah	60.50	....
Granite City, Ill.	62.40	62.90
Lone Star, Tex.	55.00	....
Neville Island (Pittsburgh)	63.00	63.00
Steelton, Pa.	62.50	63.00
Swedeland, Pa.	65.00	65.50
Toledo, O.	63.00	63.00
Troy, N. Y.	62.50	63.00
Youngstown, O.	....	60.50

NONFERROUS INGOT

(Cents per pound, carlots)

BRASS AND BRONZE: Red brass, No. 115, 35.50; tin bronze, No. 225, 48.00; No. 245, 41.50; high-leaded tin bronze, No. 305, 38.75; No. 1 yellow, No. 405, 30.75; manganese bronze, No. 421, 31.25.

ALUMINUM: 99 per cent plus primary ingots 25.90. Secondary No. 12 alloy 24.25-25.50. Deoxidizing grades: No. 1 25.50; No. 4 23.50.

MAGNESIUM: 99.8 per cent notched ingots 34.50, f.o.b. Velasco, Tex. (10,000 lb or more).

COPPER: Electrolytic 40.00 delivered Connecticut valley.

ZINC: High grade 14.85 delivered. Die casting alloy No. 3, 18.00 delivered.

IRON AND STEEL SCRAP

(Consumer prices per gross ton delivered, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Heavy Breakable Cast	Clean Auto Cast	Machinery Cast	Malleable	Short Steel Rails
Birmingham	$34.00-35.00	**$48.50-49.50	.....	.....	.....	.....	$60.00-61.00
Boston*	**38.50-39.00	**42.00-42.50	.....	.....	**43.50-44.00	.....	.....
Buffalo	44.00-45.00	**44.00-45.00	.....	.....	**49.00-50.00	.....	61.00-62.00
Chicago	44.00-48.00	45.00-46.00	.....	48.00-49.00	48.00-49.00	58.00-59.00	67.00-69.00
Cincinnati*	**44.00-45.00	**44.00-45.00	**44.00-45.00	.....	**54.00-55.00	.....	**66.00-67.00
Cleveland	45.00-46.00	53.00-54.00	43.00-44.00	52.00-53.00	54.00-55.00	54.00-55.00	65.00-67.00
Detroit*	**42.00	**46.00	**38.00	**51.00	.....	**51.00	.....
Los Angeles	41.00	46.00	.....	.....	.....	.....	.....
New York*	44.00-45.00	44.00-45.00	44.00-45.00	.....	.....	.....	.....
Philadelphia	50.00	48.00-50.00	44.00-45.00	.....	54.00-56.00	65.00-67.00	64.00
Pittsburgh	46.00-47.00	48.00-49.00	44.00-45.00	.....	54.00-55.00	.....	67.00-69.00
St. Louis*	42.00	44.00	37.00	46.00	.....	.....	66.00
San Francisco	43.00	48.00	39.00	48.00	50.00	.....	.....
Seattle	43.00-44.00	42.00-45.00	36.00-38.00	.....	.....	.....	.....

*Brokers' buying prices. **F.o.b. shipping point

NOW! A CONTROLLED PITCH

for Uniform Bond Strength

NU-BOND* PITCH

After three years of laboratory research, PENN-RILLTON COMPANY has developed a pitch that provides a solid bond of uniform strength between sand grains in cores and molds. Under average oven conditions, NU-BOND removes the uncertainties and provides bonds of uniformly high strength in mold after mold.

NU-BOND GIVES YOU UNVARYING BOND STRENGTH:

1. NU-BOND PITCH is a laboratory controlled product.
2. Raw materials are scientifically selected.
3. Chemical components kept at uniform ratio.
4. Provides bond of uniform density.
5. Assures a consistently strong bond.
6. Bond structure is solid from grain to grain.
7. NU-BOND PITCH has greater thermal stability.
8. Bonding results are reproducible.
9. Better results save you money!

*Reg. App. for

Ask your Distributor or Write to Us Directly

Manufacturers of:
Faceamol Spray-On, Hygeia Seacoal, Hygeia Pitch, Blended Core Compounds
PLANTS: Irwin and West Elizabeth, Pa.

PENN-RILLTON COMPANY

324 West 23rd Street, New York 11, N. Y.

LIKE TEST BAR—
LIKE CASTING

Shown above is the new Derrick Eccentric Motor Housing made of Frontier 40-E Aluminum Alloy.*

When the Metal is
FRONTIER 40-E* Aluminum Alloy!

When you purchase Frontier 40-E Aluminum Alloy Castings from a foundry licensed to produce this alloy, you are assured of the high qualities that have made this alloy famous. All licensees are required to send test bars to the technical research laboratory of the Frontier Bronze Corporation for complete analysis and physical testing. This quality control is strictly maintained.

Frontier 40-E Aluminum Alloy is noted for its high strength. It is also a well established fact that the physical properties that spell high quality in the test bar are duplicated in the product casting. And here's another feature of Frontier 40-E. High strength is obtained by natural aging at room temperatures. Heat treating is not necessary. Frontier 40-E Aluminum Alloy is of special value for parts that must be light in weight yet strong enough to resist distortion or deformation.

Yes, like the test bar, so is the casting when the metal is Frontier 40-E Aluminum Alloy . . . see table.

FRONTIER 40-E	TEST BAR	CASTING
Yield Strength	23,500	22,700
Tensile Strength	36,600	35,500
Elongation	7.5	7.5

*REG. T. M.

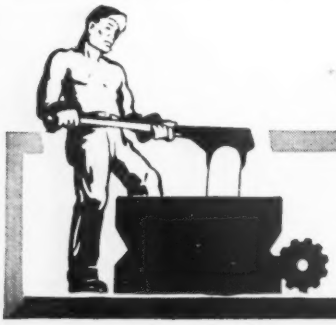
Please send me a copy of the Alloy Data Book giving Engineering and Metallurgical Facts on the physical properties of Frontier "40-E".

NAME .....

COMPANY .....

ADDRESS .....

CITY ..... STATE .....



FRONTIER BRONZE CORPORATION
4878 PACKARD ROAD, NIAGARA FALLS, NEW YORK

Circle 580 on Inquiry Card—Page 201

Circle 581 on Inquiry Card→

Even truer today

We ran this **B & W Insulating Firebrick** advertisement in 1947

24 years now

Photo courtesy Sun Shipbuilding & Dry Dock Company

Only in main arch approximately 2 feet from each end of the furnace

The furnace that PAID FOR ITSELF MANY TIMES OVER

Still lined with its original B&W Insulating Firebrick after 15 years of normalizing and stress-relieving service, this furnace is giving exceptional performance. Despite the added strain of the rigorous war years, the 80,000 B&W IFB used to line sides, ends and arch have required no appreciable maintenance!

It is no wonder the operators can report:
"This furnace has paid for itself many times over."

For furnace performance that assures highest production at lowest cost, even after years of grueling service, you can always count on lightweight B&W Insulating Firebrick. Your local B&W Refractories Engineer will be glad to help you select economical B&W Refractories for your furnaces.

B&W REFRACTORIES PRODUCTS:

B&W Allmul Firebrick • B&W 80 Firebrick •
B&W Junior Firebrick • B&W Insulating Firebrick
B&W Refractory Castables, Plastics and Mortars
B&W Silicon Carbide

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 161 EAST 42ND ST., NEW YORK 17, N.Y.
WORKS: AUGUSTA, GA.

R550

Here are FACTS about pins and bushings

1 Over 30 years ago, HINES *designed* and *produced* the *first* hard-chrome-plated and ground pins, and case-hardened, hard-chrome-plated and ground bushings.

2 Today, HINES is still the *only* producer of hard-chrome-plated pins and bushings.

3 Hard-chrome-plating of pins and bushings is the *only* successful way to prevent rust and "chattering", and insure a smooth, quick draw.

4 Perfect alignment of cope and drag is achieved *solely* by accurate machining of the flask *prior* to installation of pins and bushings. HINES flasks are machined for pins and bushings in a micrometer-adjusted jig, to guarantee perfect alignment of cope and drag.

5 HINES flasks can be equipped to your *exact* requirements, with single or double pins—round, hex or "V" type—with adjustable slides or bushings.

6 The best proof of the quality and efficiency of HINES pins and bushings, is the indisputable fact that more foundries use HINES than any other brand.

7 HINES, and only HINES, is the producer of HINES pins and bushings.

8 There's never been a satisfactory substitute for the best equipment!

THE HINES FLASK CO.

3431 WEST 140th STREET
CLEVELAND 11, OHIO

Circle 582 on Inquiry Card—Page 201

K BOND† wheels get foundry-men's O.K.

Users list many "TOUCH of GOLD" benefits for heavy duty snagging of gray iron, malleable iron and non-ferrous metals

- *K Bond wheels increased wheel-life from 80 to 120 hours. Also reduced operator-fatigue.*
- *Best and fastest wheels ever used.*
- *Cuts faster than competing wheel — longer life due to fewer dressings.*
- *Better cut, better life — are adopting as standard for cast iron boiler parts.*
- *Excellent performers. Faster cutting and longer lasting than other wheels.*
- *K Bond wheels lasting 20% longer. Best wheels in our experience.*

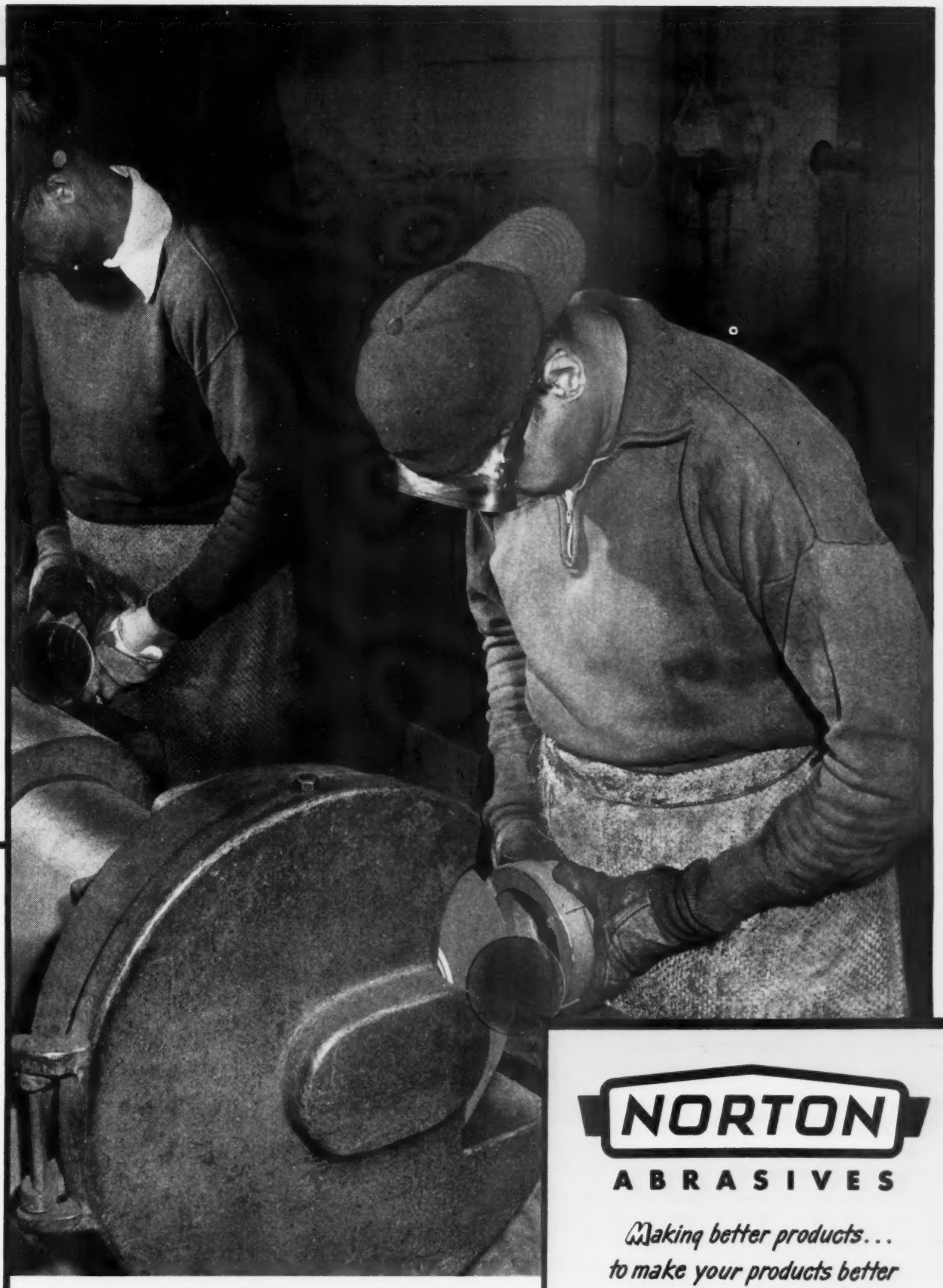
Those are typical on-the-job reports from foundries using the big Norton K Bond wheels for slow speed, heavy duty snagging of gray and malleable iron and non-ferrous metals.

The K Bond is the most radically improved vitrified bond ever developed for these applications. As a result, Norton CRYSTOLON wheels bonded with it give you these five "Touch of Gold" advantages: 1. Faster, freer cutting action. 2. Much longer wheel life. 3. Less frequent dressing. 4. Corners held better. 5. Consistent duplication.

Try them on your toughest jobs

Your Norton Distributor will gladly arrange a test of K Bond CRYSTOLON wheels in your own foundry. Give them the toughest workouts you can, on your heaviest machines. Get proof of how these revolutionary wheels will snag off more metal per dollar and cut your cleaning room costs. Or write to the nearest district office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

W-1722



JOB-PROVED ON HEAVIEST DUTY. It's your big floor stands that tell you quickest and surest just what a snagging wheel will do. On machines like these, users report, K Bond CRYSTOLON* wheels outperform and outlast all others. And they bring the same money-saving "Touch of Gold" to every type of rough grinding equipment, down to your smallest portables.

†Patent applied for
*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

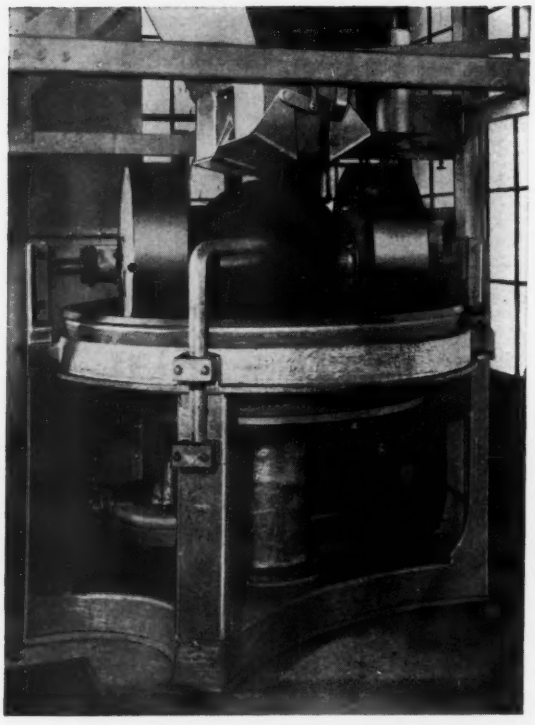
NORTON

ABRASIVES

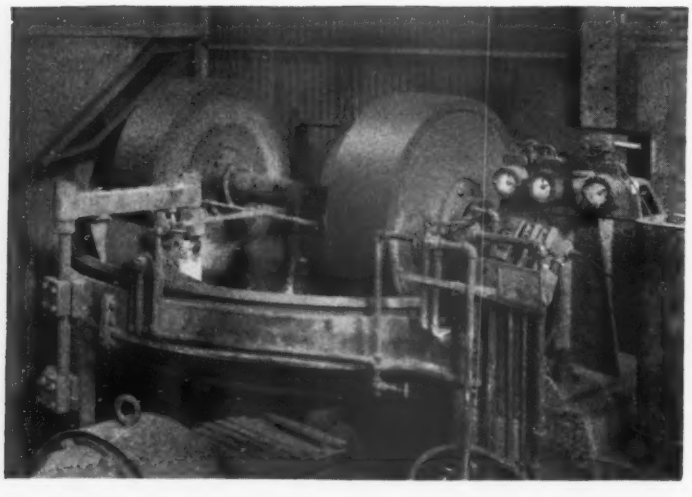
Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives Sharpening Stones • Behr-cat Tapes

the *Clearfield* mixer



speeds up your sand preparation



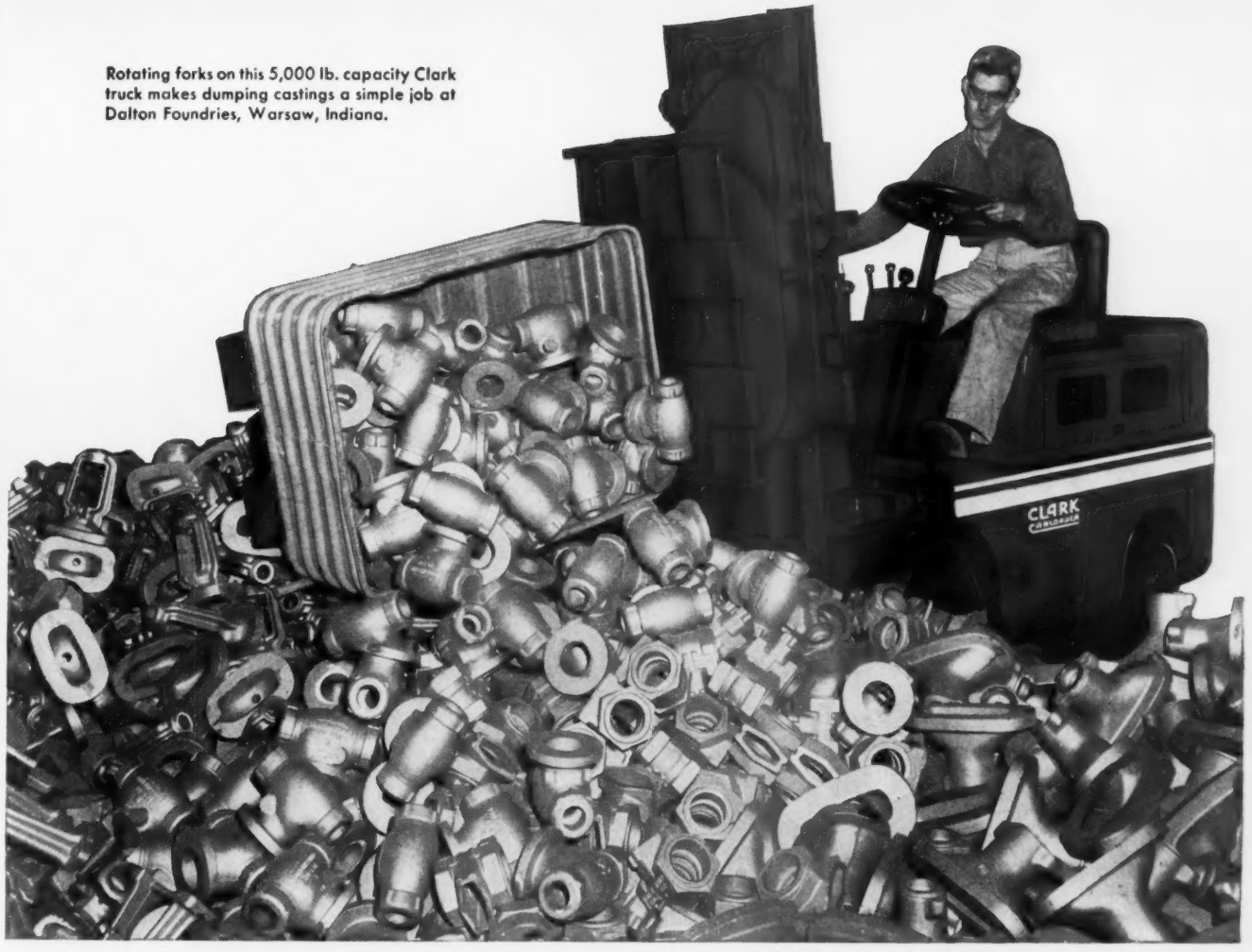
Increased speed and thoroughness in sand tempering is a reality with Clearfield Mixers. A revolving pan with vertically rotating mullers, stationary in the horizontal plane, exerts a rapid twisting, sliding movement, actually rubbing the bond on the sand grains. In doing this, CLEARFIELD MIXERS substantially reduce the tempering period and cut costs by speeding up operations.

Write today for Catalog No. 83. There is a Clearfield Mixer for every sand preparation requirement.

CLEARFIELD MACHINE COMPANY

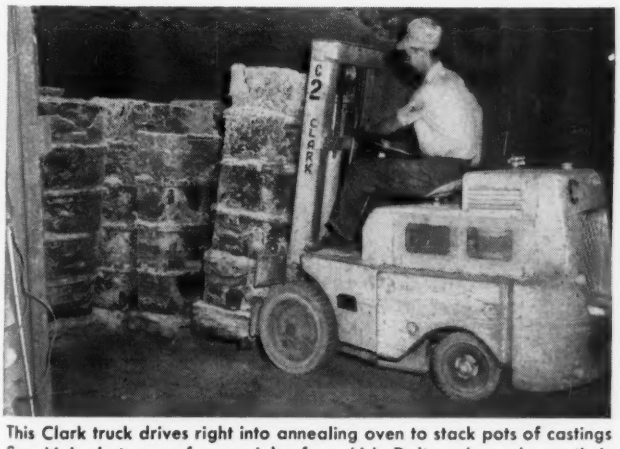
Clearfield, Pennsylvania, U. S. A.

Rotating forks on this 5,000 lb. capacity Clark truck makes dumping castings a simple job at Dalton Foundries, Warsaw, Indiana.



WHAT DOES THIS JOB COST YOU?

In Dalton's grey iron foundry, Clark trucks handle 200 tons of castings a day. At the malleable furnace *one* man now dumps 55 tons of scrap into the furnace in just 4 hours. In the annealing department Clark trucks go directly into the ovens to stack pots five high. From shakeout to shipping, Dalton's Clark trucks are lifting, moving, dumping; performing a multitude of jobs throughout the foundry at lowest possible cost. Take a close look at your own operation —what are these jobs costing *you?*



This Clark truck drives right into annealing oven to stack pots of castings five high. Just one of *many* jobs for which Dalton depends on their Clark trucks.

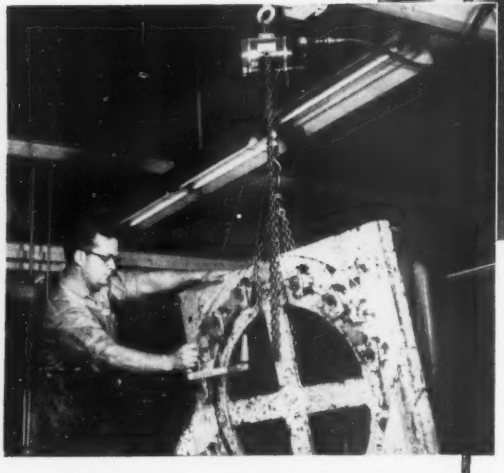
The quickly changed shovels, rotating devices, or dumping hoppers are just a few of a complete line of attachments that can make a Clark truck the most versatile tool in your foundry. Gas, LP gas, diesel or electric—from ½ ton to over 12 tons capacity—each truck able to make a specific operation just part of a dozen jobs. One Clark truck can make the competitive difference in *any* foundry, while the money saved usually more than pays for the equipment. LOOK IN THE YELLOW PAGES UNDER "TRUCKS, INDUSTRIAL" FOR THE CLARK DEALER NEAREST YOU.

CLARK® EQUIPMENT

Industrial Truck Division
CLARK EQUIPMENT COMPANY
Battle Creek 16, Michigan

AIR LIFT

Faster! *Safer!*



DOUGLAS AIRCRAFT uses ARO Link Chain Hoist in tooling shop at their Santa Monica plant. Shown here, bulkhead fixture being lowered onto flat car.

NEW LINK CHAIN AIR HOIST!*

***ROLLER CHAIN ALSO AVAILABLE—ALL MODELS**

NEW Link Chain Hoist now added to the popular ARO line . . . up to 1000 lb. jobs!

VARIABLE SPEED . . . 0 to 38′ per minute . . . load can be inched or zipped.

AIR-POWERED FOR SAFETY . . . no spark hazard . . . explosion-proof motor . . . can't burn out or overheat . . . unaffected by dust or fumes.

LIGHTWEIGHT . . . only 29 lbs. . . . overall length 10½″. Can be converted to Roller Chain type if desired.

Also available, Roller Chain Hoists—2,000 lb., 1,500 lb., 1,000 lb., 500 lb., 300 lb., 100 lb.

See Your ARO Distributor

THE ARO EQUIPMENT CORPORATION

Bryan and Cleveland, Ohio

Aro of California, 3141 S. Grand Ave., Los Angeles 7

Aro Equipment of Canada, Ltd., Toronto 15, Ontario

Offices in All Principal Cities

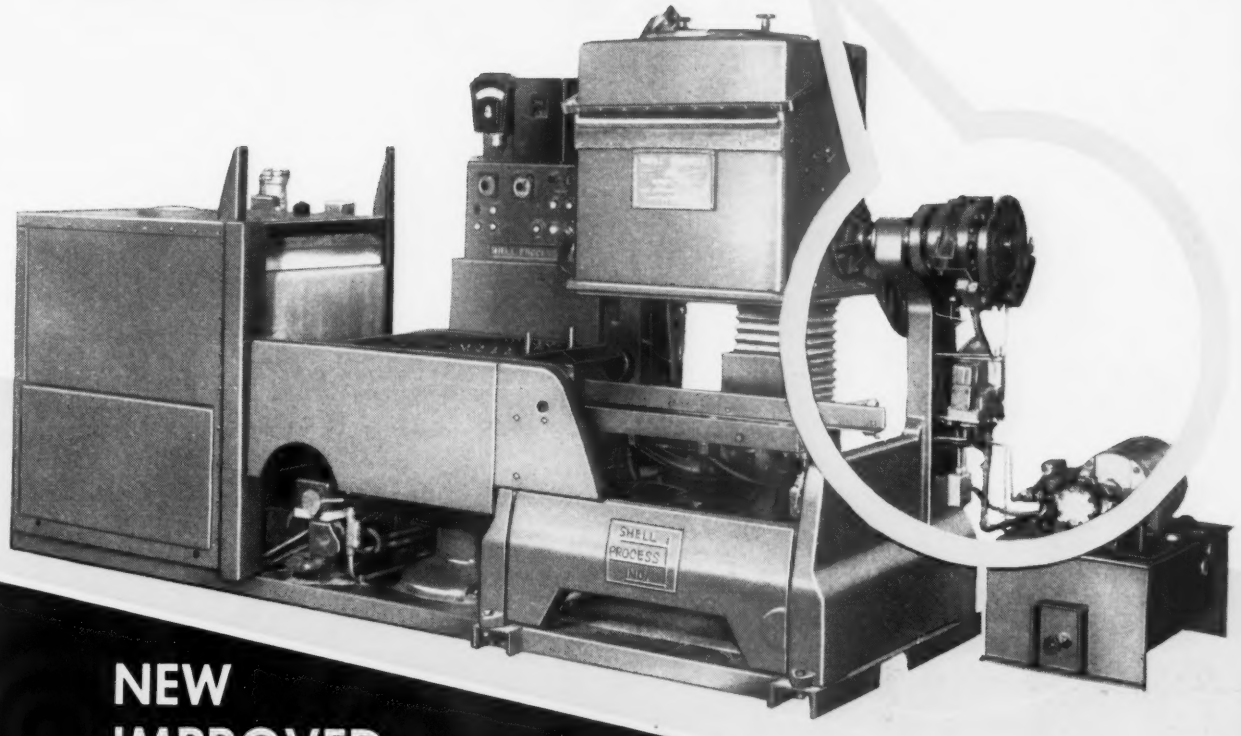
ARO ®

AIR HOISTS

Also . . . Air Tools . . . Lubricating Equipment . . . Aircraft Products . . . Grease Fittings . . .

years of development

pay off!



NEW IMPROVED

Chicopee SINGLE STATION SHELL MOLDING MACHINE

FEATURES HYDROMOTOR ROTATION OF INVESTMENT CHAMBER FOR SMOOTHER OPERATION, LOWER MAINTENANCE COSTS

The smooth operating Chicopee single station shell molding machine outproduces them all. You get deeper draws, faster operation and lower operating costs with Chicopee.

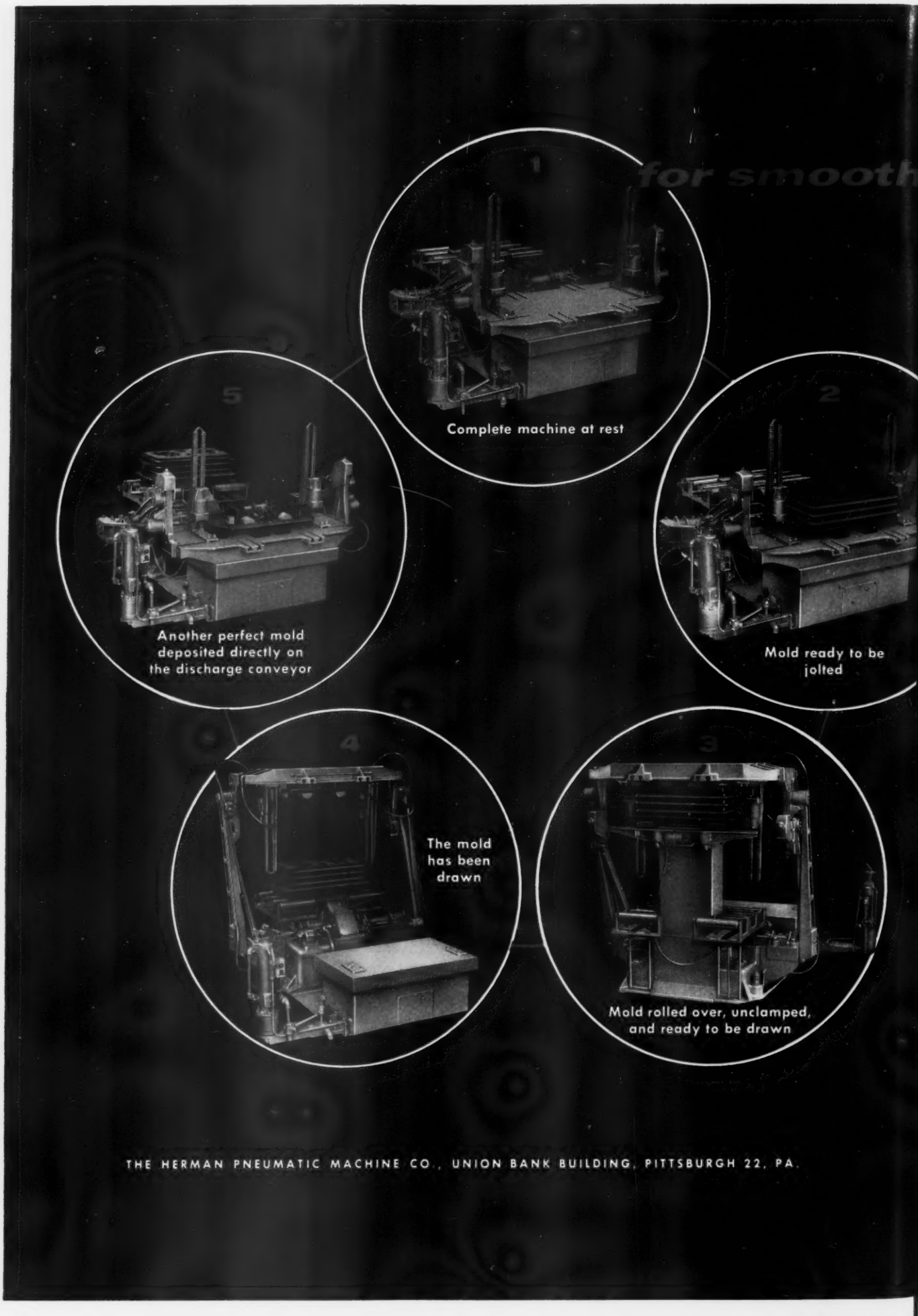
Designed for highest efficiency, built for longest life, the Chicopee can be operated by unskilled labor. You can't find better single station molding equipment.

WRITE TODAY
for detailed information on the single station molding machine and on allied products manufactured by Shell.

SHELL PROCESS, INC.

Manufacturers of Shell Molding Machines and Allied Equipment

363 McKinstry Avenue, Chicopee, Mass.



THE HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH 22, PA.

...air-on-oil performance

HERMAN

HI-SPEED
JOLT ROLLOVER
AND DRAW MACHINES

The Herman 750 and 1500 lb. Hi-Speed Machines are designed to increase production as much as 200 per cent.

Operation of these units is greatly simplified by a single valve control. Hydraulic power eliminates jerkiness, provides cushioned-action rollover and draw.

Built-in "watchdogs" automatically stop jarring action when proper density is reached . . . prevent imperfect draws by adapting leveling device of machine draw mechanism to all irregularities in flasks or core boxes.

Like all Herman Molding Machines, the Hi-Speed Jolt Rollover and Draw units are built to withstand the punishing demands of the modern foundry.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION MEMBER FEMA

HERMAN

Best Known Name in Molding Machines

Circle 588 on Inquiry Card—Page 201

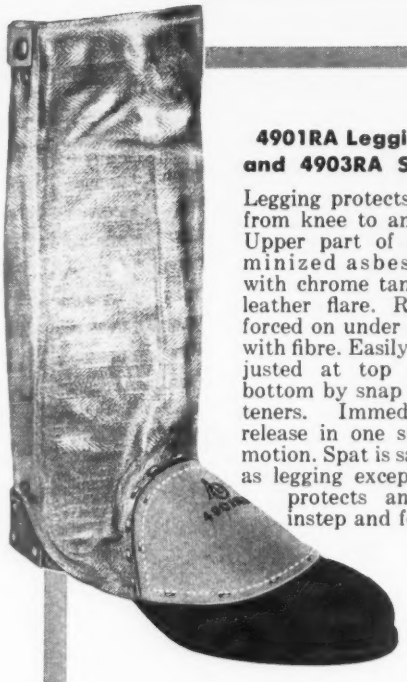
Foot and Leg Protection

For Foundry Feet
"Running a Temperature"

AO Aluminized Spats and Leggings!

Reflect 90% of Radiant Heat

Here's the foot protection you want for cupola and ladle pouring . . . open hearth, blast furnace and electric furnace tapping and other exposures to high heat. Your workers get greatest comfort *2 ways* with AO Aluminized Asbestos: (1) 90% of the heat is reflected (2) Garment weight is reduced 50%. You are sure to find the exact spat and legging you want in AO's wide line. Your nearest Safety Products Representative can supply you.



4901RA Legging and 4903RA Spat

Legging protects leg from knee to ankle. Upper part of aluminized asbestos with chrome tanned leather flare. Reinforced on under side with fibre. Easily adjusted at top and bottom by snap fasteners. Immediate release in one swift motion. Spat is same as legging except it protects ankle, instep and foot.

1481RA Spring Type Legging

Very popular because no adjustments are necessary. Easy on, easy off! Spring steel frame not only helps protect leg from impact but creates air space between leg and legging. Has chrome tanned leather flare with spring clip.

7X160RA Legging and 7X161RA Spat

Legging is preferred by many because of unusual design and features. Has spring clip on chrome tanned flare. 3 positions at top and 2 at ankle for steel stay permit snug fit and quick release. Upper part of aluminized asbestos. Spat is same as legging except it protects ankle, instep and foot.

1481RAR Renewable Spring Type Legging

Same as 1481RA Legging except parts are replaceable. Covering (attached to frame by snap fasteners) can be removed and replaced. If damaged, either frame or covering can be ordered separately.

American Optical
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

you live with BRICK . . . 24 hours a day!

365 days and nights a year, you come in contact with products born in and from refractory brick.

Your office and everything in it. Everything you see and touch . . . everything that's made or moves owes its very existence to refractory brick. Refractories—containing and controlling the flames of industry—produce the steel, electric power, rubber and cement you use *continuously* in daily living.

And the making of refractory products is the most basically necessary industry there is.

Refractories, you see, create industry . . . without them, there would be no industry.

Providing industry with Castables, Plastics, Ramming Mixes, Fire Brick, Mortars, Insulating Brick and Insulation, General Refractories Company draws resources from all over the globe—and operates the world's largest, most-modern refractories research laboratory.

A Complete Refractories Service

GENERAL REFRACTORIES COMPANY
Philadelphia 2, Pa.

A COMPLETE REFRACTORIES SERVICE FOR THE FOUNDRY INDUSTRY

BRIKRAM 80, a high alumina ramming mix, is giving outstanding service in many foundry furnace applications.

BRIKRAM 80 when rammed in place behind rigid forms, forms an excellent refractory lining wherein temperature and resistance to strong flux or slags are desired. BRIKRAM 80 is used to construct the lower side walls and bottoms of aluminum melting and holding furnaces, center sections of electric furnace roofs and side walls and bottoms of malleable iron furnaces.

BRIKRAM 80, because of its high alumina content, is recommended for use in desulphurizing units where soda ash and other potent fluxes are used. Ladle life can also be increased by using BRIKRAM 80 in the places where the severe wear occurs. In case of ladles holding high temperature stainless steel, or other metals, long service is given by BRIKRAM 80.

For abrasion conditions, HIGH STRENGTH BRIKRAM 80 is available. This material takes a very hard air set and maintains it up to the softening point of the material.

Consult your local GREFCO representative for more complete details of these, and other GREFCO, products.

GENERAL REFRACTORIES

Circle 590 on Inquiry Card—Page 201

Do Your Cores Score High

on each of these

19 VITAL POINTS ?

CORE & BINDER CHECK CHART

NOTE: Rate your cores on each point in column at left. Note in columns at right which Corn Products Binders provide highest degree of the qualities you need. For friendly help in developing a special formulation call on the man from Corn Products.

Check Here	Factor	1	2	3
———	Green bond	Mogul	—	—
———	Dry bond	Kordek	Dextrine	Mogul
———	Green sand	Mogul	Dextrine	—
———	Dry sand	Kordek	—	—
———	Flowability	Dextrine	Kordek	Mogul
———	Collapsibility	Dextrine	Kordek	Mogul
———	Scratch hardness	Dextrine	Kordek	—
———	Sound castings	Mogul	Kordek	Dextrine
———	Reduced baking	Mogul	Kordek	Dextrine
———	Better blowing	Mogul	—	—
———	Easy ramming	Mogul	—	—
———	Simplified mixing	Kordek	Dextrine	Mogul
———	Easy shake-out	Mogul	Kordek	Dextrine
———	Finer casting finish	Mogul	Kordek	Dextrine
———	Uniform mixing	Mogul	Kordek	Dextrine
———	Dry state, easily handled	Mogul	Kordek	Dextrine
———	Less handling, less waste	Mogul	Kordek	Dextrine
———	Corepaste	Kordek	—	—
———	Reduced costs	Mogul	Kordek	Dextrine

ARE YOU PACKING THE RIGHT SAND, right binders for a top-scoring formula? For friendly advice *ask the man from Corn Products.*

DO YOUR CORES SCORE HIGH on baked strength, surface hardness, collapsibility, shake-out? *Check with the man from Corn Products.*

The chart above shows *19 different points* in sand formulation and use where you can gain or lose casting quality and foundry time and dollars. Check each one against your own operation —and see where you can *not* honestly answer, "Perfect!"

Is your mixing and ramming quick, easy, certain? Cores high in green strength—fully sag-resistant? Do you score high on every point in baking, storage, casting? Check and double-check—see how you really rate. Then remember this:

MOGUL, KORDEK or DEXTRINE may give you top score on every point. High in green strength, baked strength and surface hardness respectively, they form the basis of any sound formula.

*Ask the man from Corn Products**—There's a just-right sand formulation that can save you untold time and trouble, assure superior quality castings, increased production. And *you* can develop it. Our technical department offers the friendly cooperation of experienced men on our foundry staff. They will work with you to solve any sand or related problem. They've helped solve hundreds of problems for others, can help solve yours.

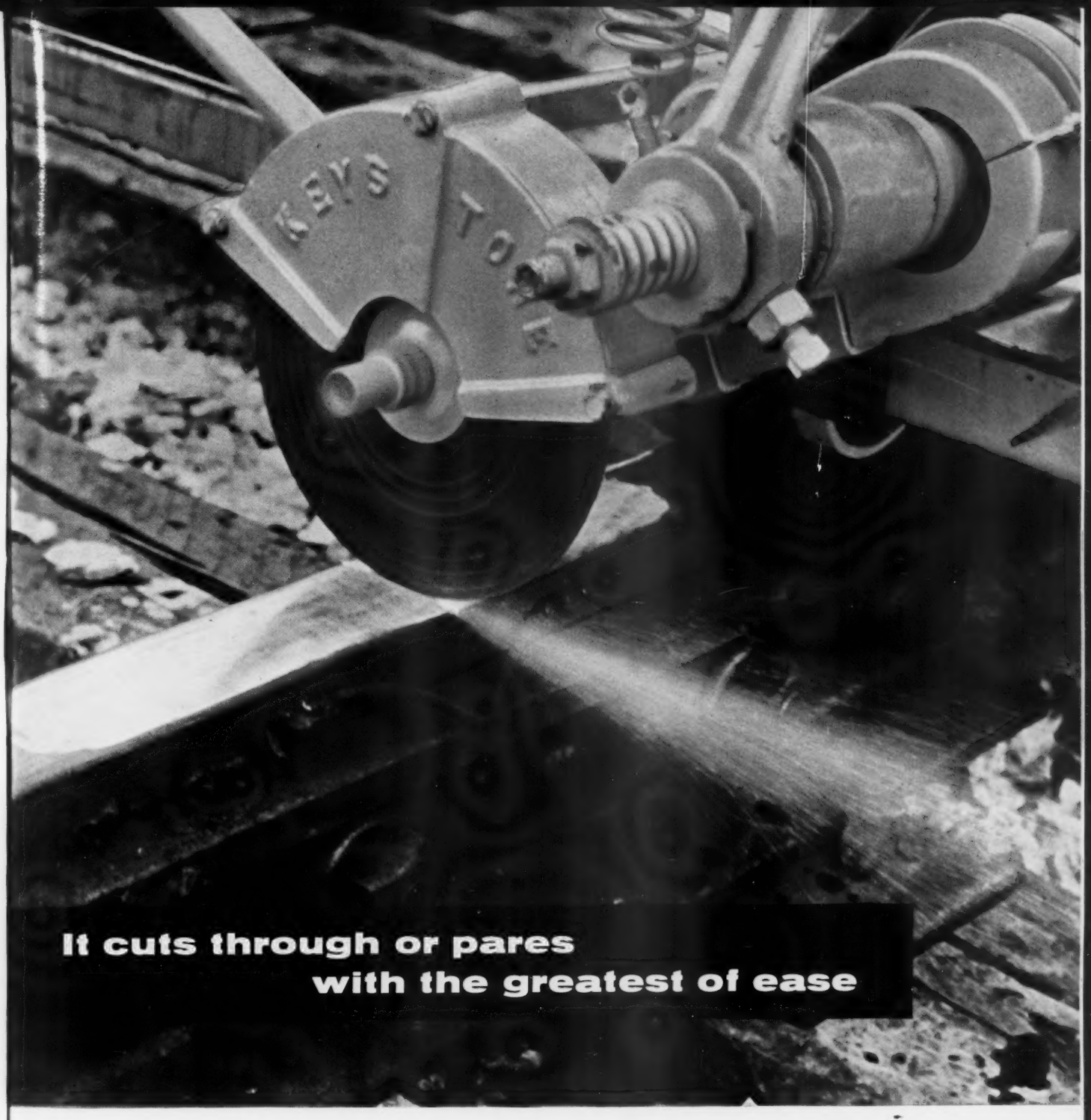
***Corn Products Specialist in core room and foundry practice. Services available FREE!**

1906 • **50th ANNIVERSARY** • 1956
CORN PRODUCTS REFINING COMPANY
17 Battery Place, New York 4, N. Y.

Makers of MOGUL® • KORDEK® • GLOBE® dextrine

Circle 591 on Inquiry Card—Page 201

Circle 592 on Inquiry Card→



It cuts through or pares with the greatest of ease

Rugged jobs that crack ordinary wheels are no problem for CARBOFLEX® Cut-Off Wheels by CARBORUNDUM! The fiber-reinforced resin bond is designed to withstand extremes of side pressure and heat shock. This extra strength means maximum safety... plus two to three times longer wheel life! Both sides of CARBOFLEX® wheels are knurled, to eliminate binding. There's no flexing and drifting, even on long cuts or uneven surfaces. CARBOFLEX® Cut-Off Wheels come in four gradings, in diameters up to 20 inches, for every cutting, notching, slotting job.

A phone call to your CARBORUNDUM Distributor or salesman will set up a trial in your shop. For Folder A-1298, giving applications and recommendations, write The Carborundum Co., Niagara Falls, N. Y. In Canada: Canadian Carborundum Co., Ltd., Niagara Falls, Ontario.

Through application "know-how" and product quality

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

6B11 PRINTED IN U.S.A.

LET'S LOOK at

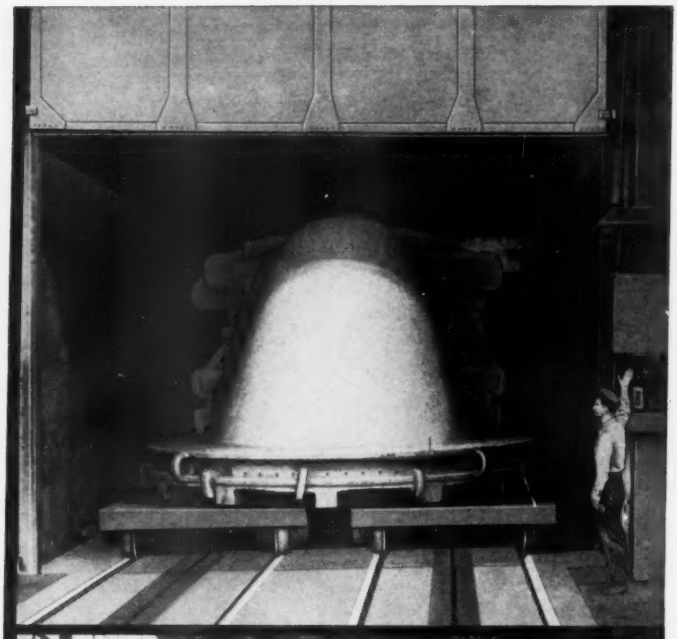
OVENS for every baking requirement

OVENS that will be faster and less expensive to operate

OVENS that are designed to best fit your operation

Carl Mayer designs and manufactures all types of ovens as well as "specials" to meet unusual operating conditions. Most incorporate the Carl Mayer recirculating heating system with sealed combustion chamber that keeps gases from prematurely escaping into the load area. Cores and molds are baked evenly with no burning. Temperatures are always under control.

Write for Bulletin 53-CM



TOP RIGHT—This large car type mold oven is installed at Pittsburgh Steel Foundry. Its special triple slotted panel construction reduces heat loss 1/3. Fuel savings up to 50% over old conventional methods are possible. Drying time is often cut in half and temperatures are uniformly controlled.

MIDDLE RIGHT—This rack type core baking oven is at the Fremont Foundry Co., Fremont, Ohio. It is equipped with a recirculating combination gas-oil fired heating system.

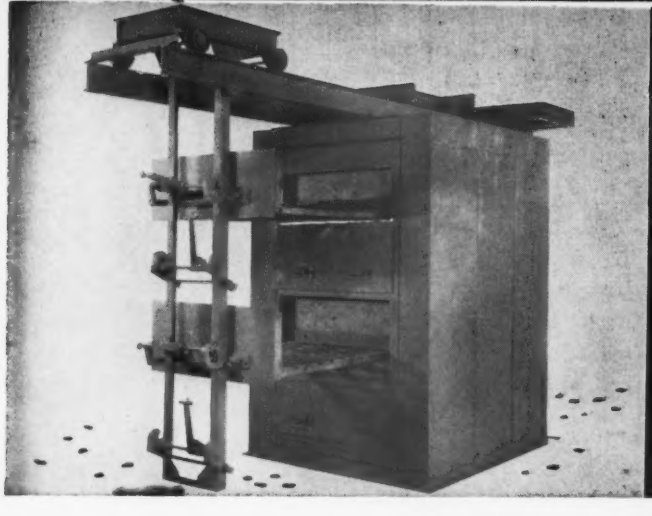
BOTTOM RIGHT—Vertical Core Oven (unloading position) at A. C. Williams Company, Ravenna, Ohio. This oven is 11'-0" wide x 11'0" deep x 45'-0" high.

BELOW—Our standard rolling drawer type core baking oven. The heating equipment (not shown) may be mounted on floor beside unit or on the roof. Particularly adaptable to brass and aluminum foundries.

THE **carl mayer** CORP.

3030 EUCLID AVENUE CLEVELAND 15, OHIO

OTHER PRODUCTS: Heat Treating Ovens and Furnaces • Rod Bakers • Welding Rod Ovens • Paint and Ceramic Drying Ovens • Special Processing Equipment and Accessories



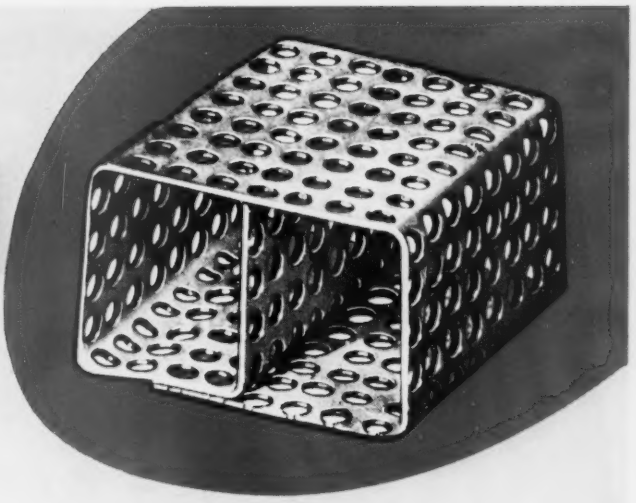
for light core castings

fine FANNER perforated chaplets

Provide

6 BIG

advantages



COMPLETE FUSION—Large number of perforations in light metal insure perfect fusion in light casting

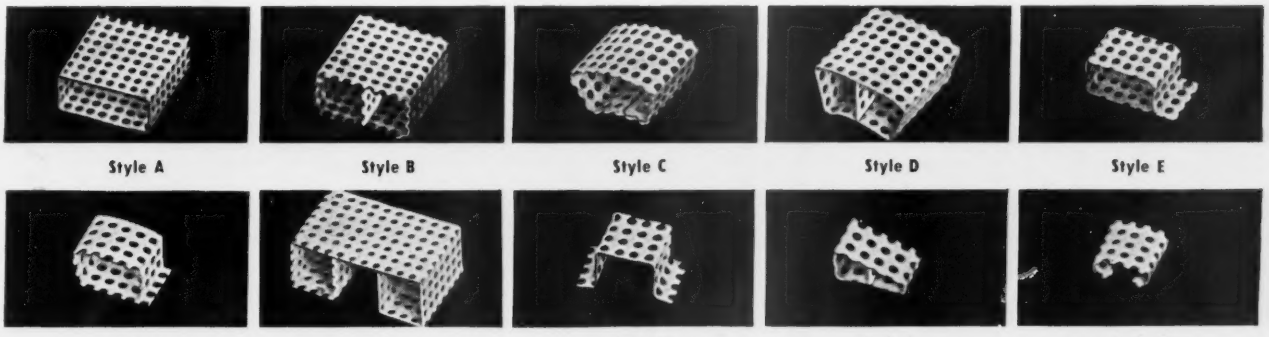
WILL NOT CHILL — Because of the large perforated area, there is no concentration of metal at any point to chill and cause leaks

PERFECT VENT — There are no gas or air pockets to cause "blow holes", so that perfect ventilation is assured

LARGE SUPPORT AREA — Widely distributed support area holds core more securely in place

FLEXIBLE SHAPE — Made in 10 styles in any shape or contour required, flat or curved to any radius, wedge-shaped, bridged or with extended ends

ACCURATELY MADE — Produced to exacting standards on specially designed machines to meet specifications



Style A | Style B | Style C | Style D | Style E

Style F | Style G | Style H | Style I | Style J

For light core work you can depend on Fine Fanner Perforated Chaplets to give you perfect core support and complete fusion. These versatile chaplets have the precise features for your particular job . . . the right shape, the right size, the right construction and the right material. They are made of tin coated sheet steel, aluminum, copper or brass Fine Fanner Perforated Chaplets are available in a large number of types, some of which are illustrated and in a wide range of thicknesses and sizes.

If you don't know all about the many advantages of Fine Fanner Perforated Chaplets . . . write for the Fanner Chaplet Catalog today!

Engineering Service . . .

Qualified and specialized engineers in FANNER'S Technical Service Division are available for consultation, without obligation, or problems of producing more intricate castings; developing increased strength, closer tolerances, and better quality; reducing machining and improving finish — both in ferrous and non-ferrous castings. Take advantage of the research and development work that FANNER has invested in this field to improve your profit picture. Simply direct your request to the address shown below.

THE FANNER MANUFACTURING CO.

BROOKSIDE PARK CLEVELAND 9, OHIO

Designers and Manufacturers of Fine Fanner Chaplets and Chills

Circle 594 on Inquiry Card—Page 201

Custom Built in
any Length, Width or Depth

ADAMS CHERRY EASY-OFF FLASK

These advantages will cut your production costs!

SIDES AND ENDS finished 1⅛" on all standard size flasks. 1¼" and heavier on flasks of larger perimeters and depths. Cherry lumber is finest available; air dried.

SOLID CORNERS are machine locked to maintain alignment and to insure maximum rigidity.

MALLEABLE TRIMMINGS are another famous Adams feature; assure long life and exceptional service.

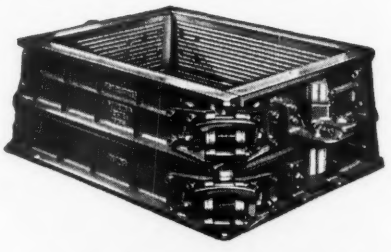
OPERATING MECHANISMS are completely new in design, yet of proven construction. Exceptionally simple, offering single-point adjustment; ease of operation on tough jobs.

ADJUSTMENTS made *only* when mechanism is in *locked* position.

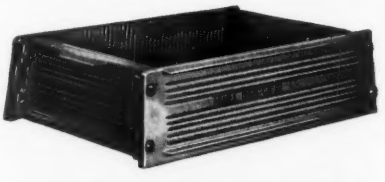
SPECIALLY DESIGNED INSERTS located in main body castings permit reversal of locking position. As "standard" flasks are furnished with handles locking in "up" position. To change, remove main bolt handles and inserts, reverse inserts and handles and reassemble.

STEEL PROTECTING STRIPS are standard equipment at top of cope, bottom of drag and at parting. Aluminum strips available upon request at no extra charge.

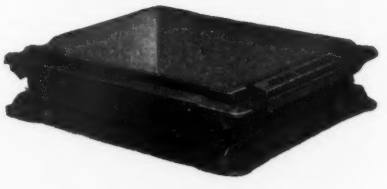
WIDE "V" PINS & EARS standard on all flasks. All other types of pin and ear arrangements are available to interchange with your present pattern plate guides.



Adams Aluminum Easy-Off Flask



Adams Jackets, Cast Iron or Aluminum



Adams Steel Jackets

For the most complete line of flask equipment available . . . always look to Adams!

The ADAMS Company

Established 1883

MOLDING MACHINES and FLASK EQUIPMENT

700 FOSTER STREET, DUBUQUE, IOWA, U.S.A.

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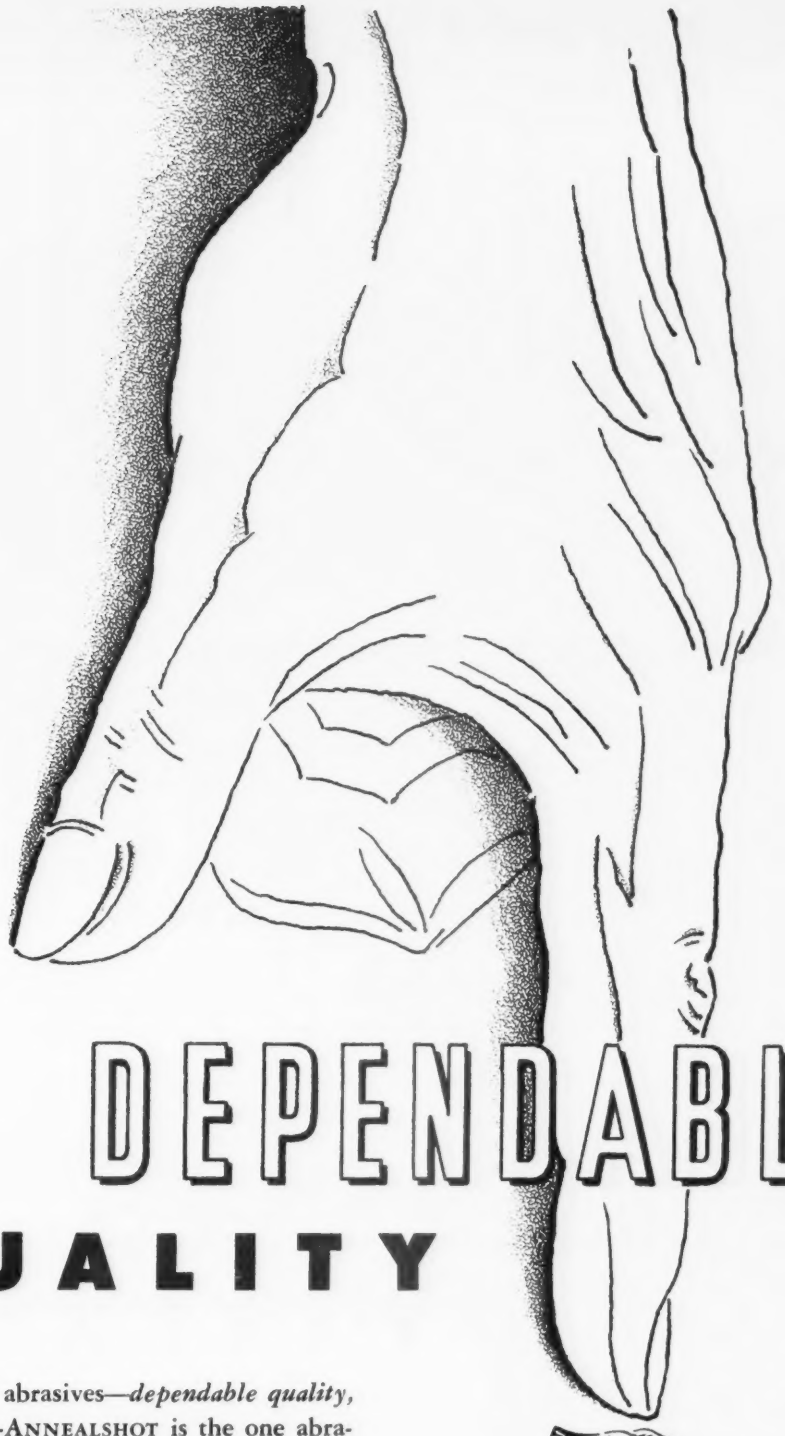

DEPENDABLE QUALITY

When it comes to quality in abrasives—*dependable quality,* that is—Metal Blast's SUPER-ANNEALSHOT is the one abrasive that's really pointed out! It's the finest malleableized abrasive that modern production methods ever developed. We use the best of raw materials, heat treated in automatic, scientifically-controlled furnaces. And we make a good deal of this good shot and grit, for a lot of good customers—so that mass production keeps prices low. When you're ready to buy—give SUPER-ANNEALSHOT a try. You'll be glad you did!

METAL BLAST, INC.

872 EAST 67th STREET • CLEVELAND 3, OHIO

PRODUCING THE FINEST CHILLED AND MALLEABLE SHOT AND GRIT ON THE MARKET

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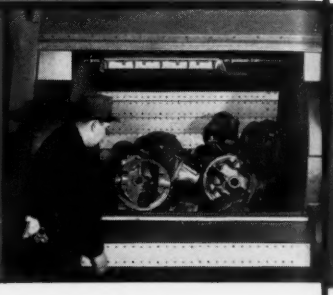
YOU CAN

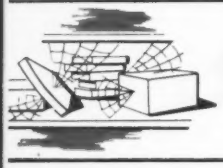
WITH A

if you

IF your performance results do not measure up to these SUPER SAVINGS it will pay you to investigate the WHEELABRATOR SUPER TUMBLAST

DAYTON MALLEABLE IRON CO.
(Ironton Div.)
Ironton, Ohio



Saves **CLEANING TIME**	Cleans toughest work faster than 2-wheel machine.
 *Saves* **WEARABLES**	Over 530 hours on one set of blades.
Saves **ABRASIVE**	No abrasive gets out of the machine. The door stays tight.
Saves **MAINTENANCE**	"This machine is designed for the maintenance man", says the maintenance foreman.
Saves **MAN HOURS**	Automated operation relieves operator for other duties.

Write today for your free copy of this 12-page, fully illustrated brochure. Ask for Catalog No. 125-D.

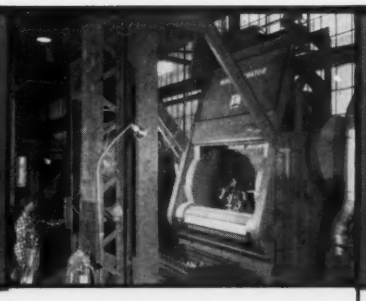
WORLD'S LARGEST MANUFACTURERS OF AIRLESS BLAST CLEANING EQUIPMENT AND STEEL ABRASIVES

NSAVE MONEY

A WHEELABRATOR® SUPER TUMBLAST

ou operate batch-type cleaning equipment

UNITCAST CORP.
Toledo, Ohio



Cleans deep core work as fast or faster than 2-wheel machine.

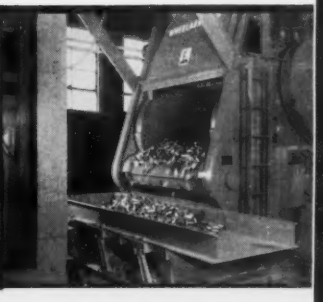
Over 1,000 tons cleaned and liners are just getting polished.

The separator removes sand and scale and keeps all abrasive in the machine.

"Lowest maintenance blast equipment in our shop".

Trouble-free operation eliminates down-time.

INDIANA FORGE & MACHINE CO.
East Chicago, Ind.



Cleans twice the volume in half the time formerly required in smaller machines.

Not a single wearable part has been replaced in over 8 weeks of operation.

68% reduction in abrasive costs, using Wheelabrator Steel Shot.

Maintenance negligible.

No direct labor. Trucker operates machine.

WHEELABRATOR

505 S. Byrkit Street CORPORATION Mishawaka, Indiana

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TO HIT PAR GO AROUND WATER HOLE!

(or how control keep score *low*!)

CHIEF KEOKUK:
"My golf ball like turtle, always head for water."
PRINCESS WENATCHEE:
"Little Chief use brains . . . go around water hole."
CHIEF KEOKUK JR.
"Control makes golf game good."

Around the 18 . . . or in processing iron and steel, control plays an important role. Many foundries and steel plants control costs and quality with Keokuk Silvery Pig Iron . . . the superior form of silicon introduction. Pig for pig, car for car, its uniformity never varies. Handle it by magnet . . . charge it by weight (or count the piglets for equal accuracy). Leading aluminum producers specify Keokuk Silicon Metal for uniform high purity. When you think of silicon think of Keokuk.

KEOKUK ELECTRO-METALS COMPANY KEOKUK, IOWA
Wenatchee Division, Wenatchee, Washington

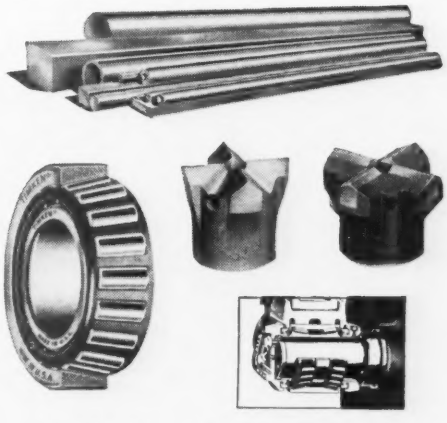
SALES AGENT: MILLER AND COMPANY
332 S. Michigan Avenue, Chicago 4, Illinois
3504 Carew Tower, Cincinnati 2, Ohio
8230 Forsyth Blvd., St. Louis 24, Missouri

Keokuk Silvery Pig Iron is available in 60 and 30 pound pigs and 12½ pound piglets . . . in regular analysis or alloyed with other elements to match your requirements.

You mean what you say, when you say "TIMKEN"

IF you are content with just any old kind of tapered roller bearing, steel or rock bit, of course you don't specify "Timken". By the same token, when you want highest quality you don't specify anything *but* "Timken". To make sure you get what you want—to safeguard your reputation and ours—we stamp "Timken" on every product we make. When you say "Timken" we know you *mean* a product made by the Timken Company . . . because, as everyone is aware, "Timken" is a trade-mark, not *just a type of product.*

When you purchase tapered roller bearings, alloy steel bars, seamless steel tubing or removable rock bits, always look for this famous legal identification. When you see it, you know there are over 55 years of experience behind it. When you *say* it, you're saying exactly what you mean: "I want the best." The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS • REMOVABLE ROCK BITS • FINE ALLOY STEELS

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uniform HEAT for BIG jobs!

at morgan engineering—alliance, ohio

This 52′ x 21¼′ x 17½′ high car bottom furnace was designed by Morrison Engineering to stress relieve heavy weldments. The furnace is available for use by other firms on a subcontracting basis. It has the second largest car bed area of any such furnace in the world.

Imagine getting a **uniform heat** throughout a 250,000 pound load of steel with 3" to 10" thick sections in such a huge furnace! 48 North American No. 223-4 Dual-Fuel Burners do the trick. These burners, arranged in 4 banks and 3 zones, can burn 250 gallons of oil per hour, releasing 33 million Btu. They maintain a stable fire even when operating with a large amount of excess air to attain good temperature uniformity.

All the air is supplied by a North American Turbo Blower. North American pilots, valves, and Ratiotrols provide a safe, effective control system.

for additional information consult your local n. a. engineer or write for bulletin 223

NORTH AMERICAN COMBUSTION since 1917

the **NORTH AMERICAN** mfg co

Combustion Engineers

4455 East 71st St. • Cleveland 5, Ohio

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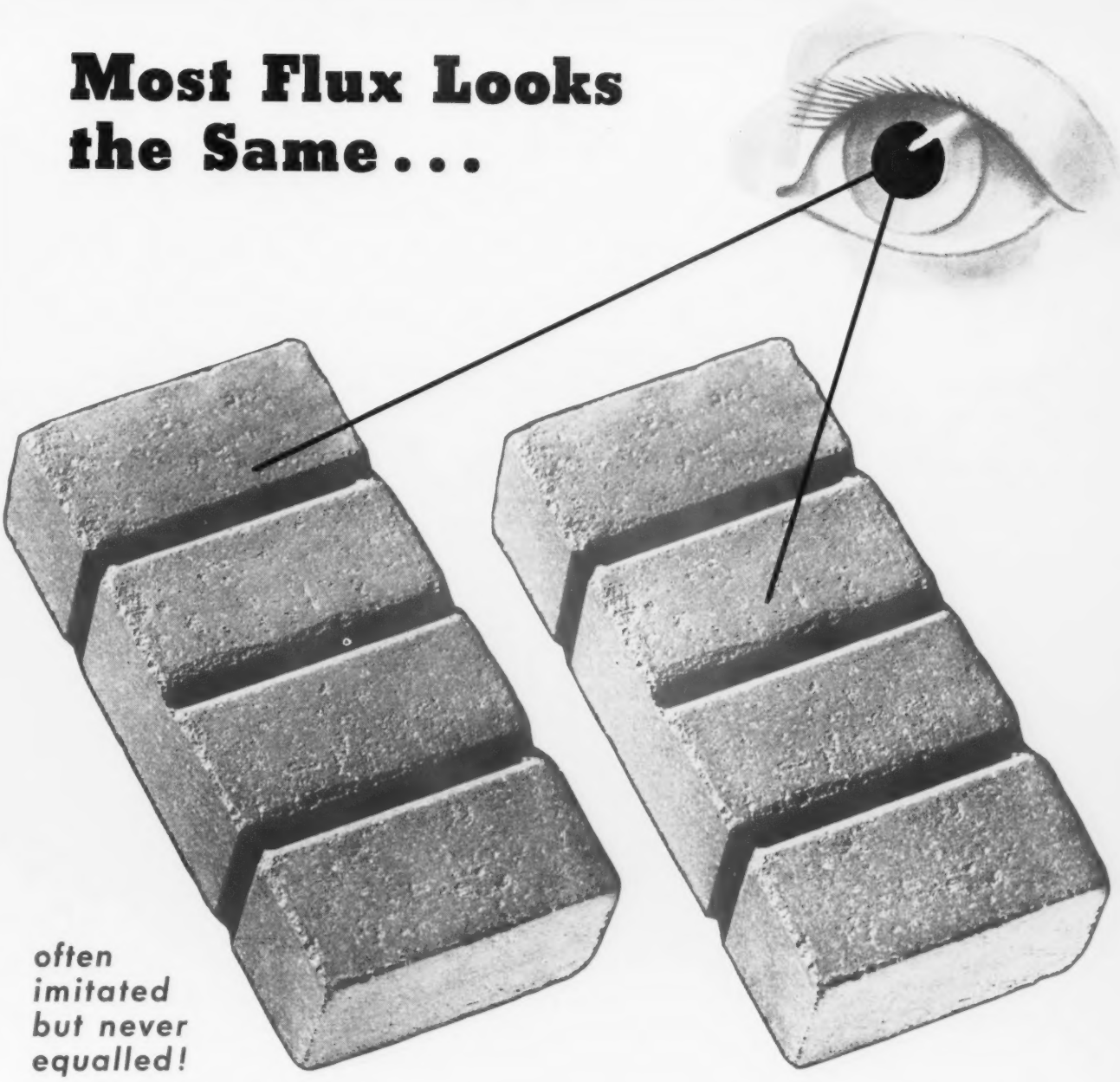
Circle 601 on Inquiry Card→

Most Flux Looks the Same...



often imitated but never equalled!

The Difference Shows in the Iron!

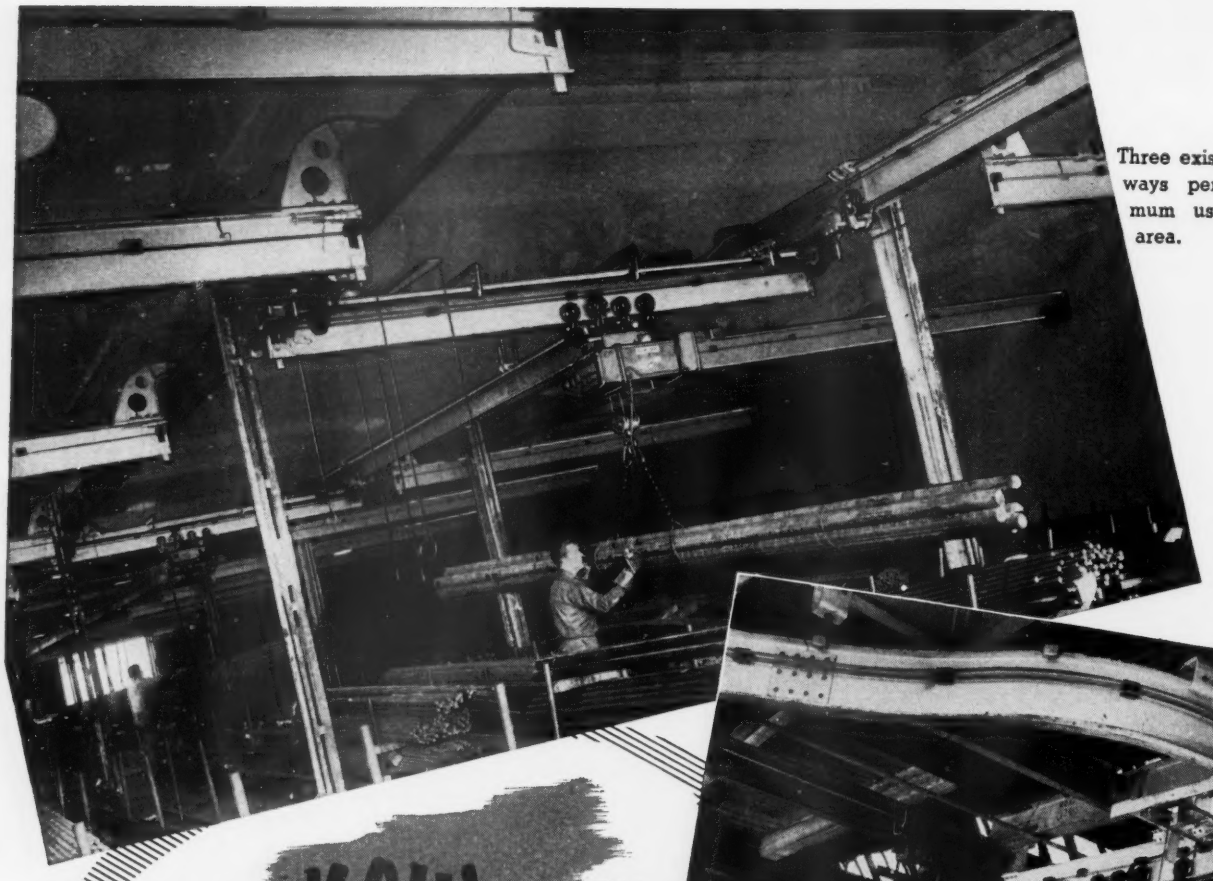
Famous Cornell Cupola Flux produces a cleaner metal with greater fluidity. You get superior castings with better machinability, greater tensile strength, uniformity of hardness and more uniform graphite distribution from light to heavy sections.

This superior flux increases efficiency in cupola operation giving you cleaner drops with bridging over practically eliminated! Hundreds of foundries now use Cornell Flux. If you are not one of them it will pay big dividends to investigate now!

If you melt aluminum or brass, try Famous Cornell Aluminum and Brass Flux. Write for Bulletin 46-A

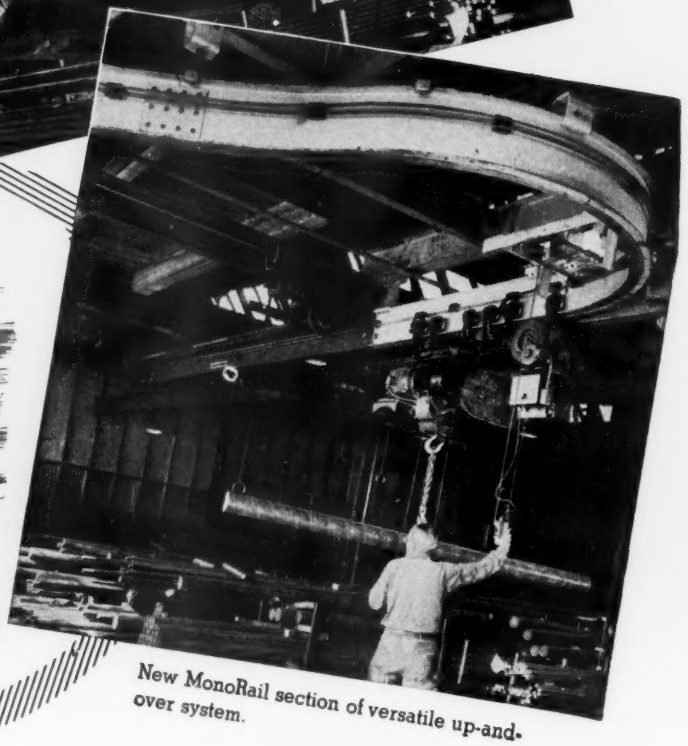
The CLEVELAND FLUX Company
1026-40 MAIN AVENUE, N. W. • CLEVELAND 13, OHIO
Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918

FAMOUS CORNELL FLUXES
Trade Mark Registered



Three existing craneways permit maximum use of floor area.

new MONORAIL ties into old... for flexible system



New MonoRail section of versatile up-and-over system.

A newly engineered section was added to three existing MonoRail craneways in this bar stock warehouse. As a result, incoming material can be picked up from a car and transported on this highly efficient overhead system to storage area. When the raw stock is needed, this up-and-over system has it there on schedule. If you have a materials handling problem, call your nearby American MonoRail engineer. He is qualified to help you answer it.

Member of Materials Handling Institute - MonoRail Association

Photos courtesy of Super Steels, Inc., Chicago, Ill.

AMERICAN OVERHEAD HANDLING EQUIPMENT

MONORAIL COMPANY

13104 ATHENS AVENUE
CLEVELAND 7, OHIO

Over 60 Years of Dependable Service to the Foundry Industry

We're looking forward—not backward. Today, in a new plant, with modern manufacturing facilities, The Shanafelt Co. is building the finest steel flask in its many, many years of building this dependable product. And there are new improvements ahead.

It is a great satisfaction to realize that we're here today because foundrymen have found our products good, our prices sensible, and our promises dependable. Let us assure all our friends that, while we'll always change and improve our products, we'll never change the fundamental policies that have given us these 63 successful business years.

THE SHANAFELT MANUFACTURING CO.

2600 - 2700 Winfield Way N. E., Canton, Ohio

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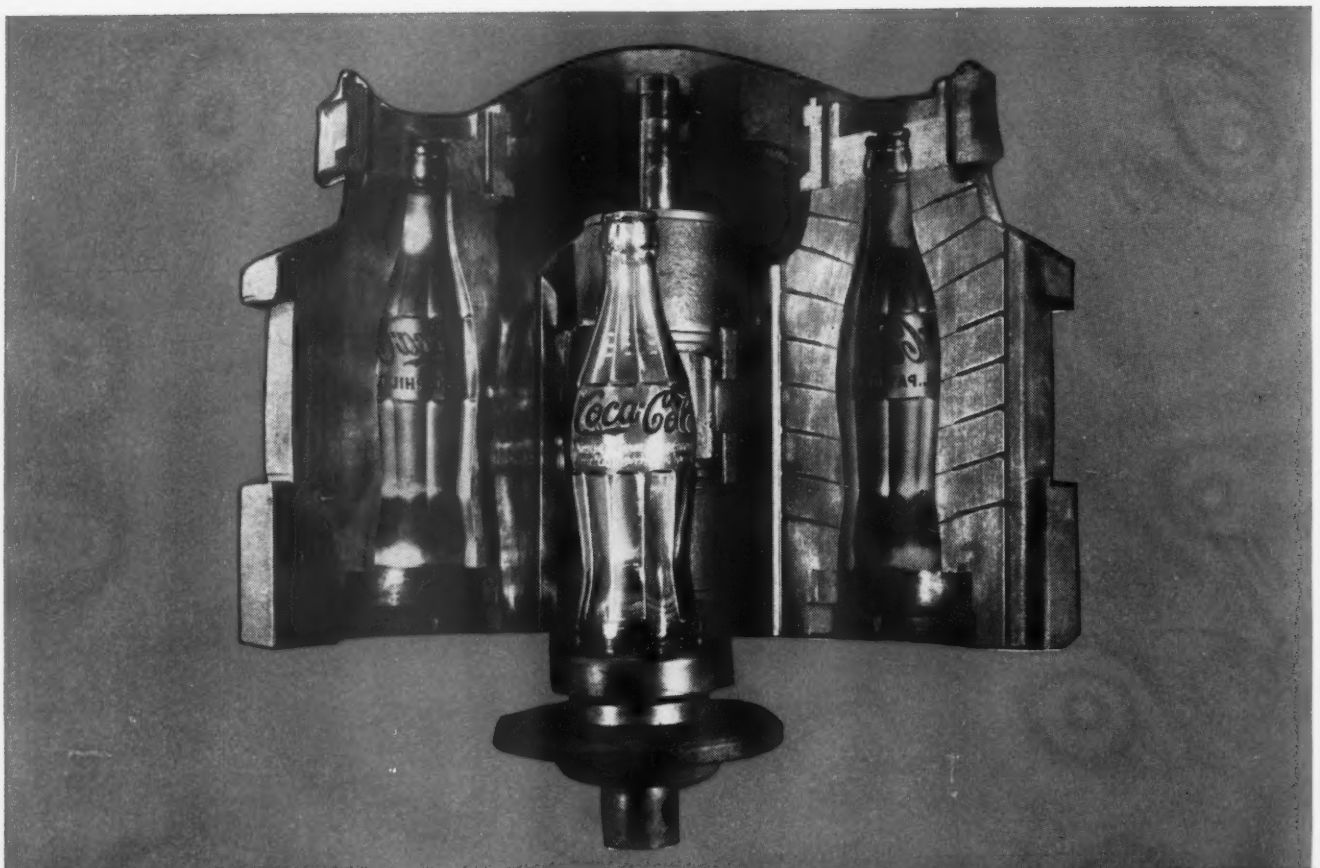
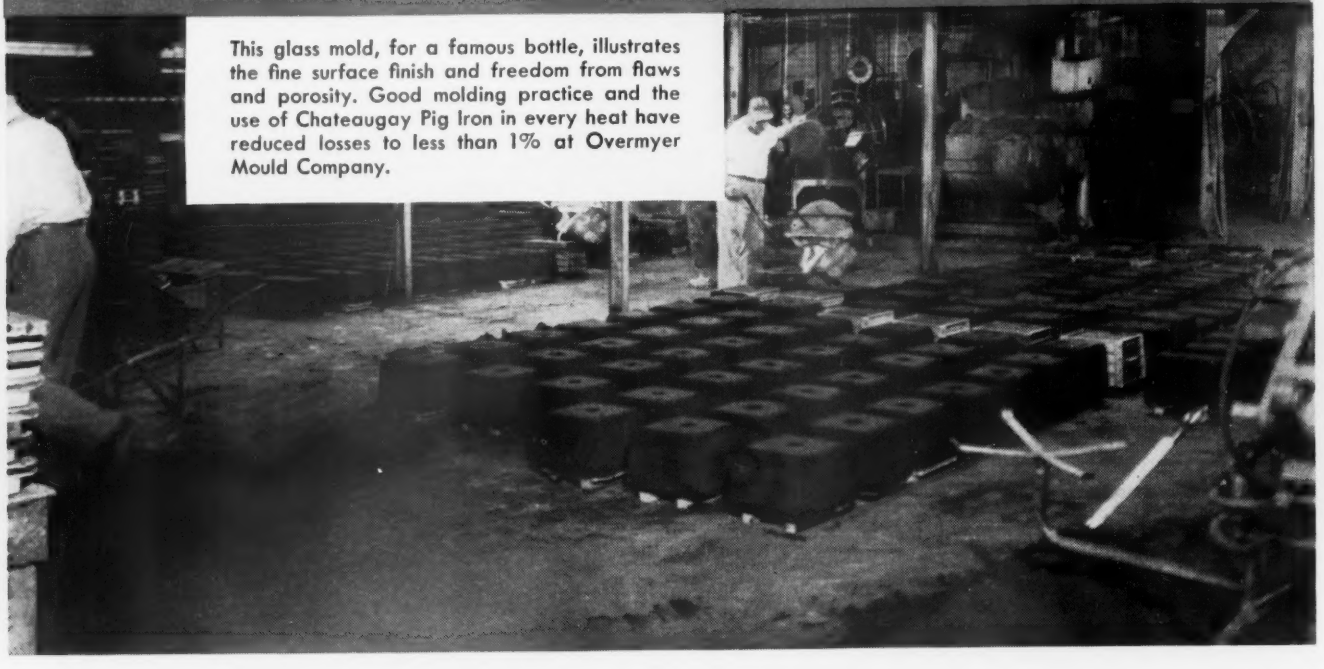


This glass mold, for a famous bottle, illustrates the fine surface finish and freedom from flaws and porosity. Good molding practice and the use of Chateaugay Pig Iron in every heat have reduced losses to less than 1% at Overmyer Mould Company.



REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

How Chateaugay Pig Iron helps glass-mold foundry cut losses to less than 1%

It takes a good pig iron to meet the rigid casting requirements of Overmyer Mould Company, Winchester, Indiana, producers of molds for manufacturers of glass containers.

The molds are machined and hand finished to obtain extremely smooth surfaces. Some molds call for a tolerance of +.002 to −.000. Therefore, the castings must be perfect from a density standpoint. The slightest flaw or evidence of porosity would cause them to be rejected. Yet, Overmyer is able to keep its loss rate under 1%.

How do they do it? By using Republic Chateaugay Pig Iron in every heat, including heats of nodular iron. The company has found through actual experience that there is no better nor more economical means for insuring flaw-free, easy-to-machine castings.

Chateaugay is a low-phosphorus, copper-free pig iron. Its highly uniform distribution of chemical elements assures a dense, fine grain structure throughout every casting, regardless of size or shape.

Overmyer's foundry superintendent points out that in addition to providing good densification, fine surface finish, heat-resistance, high strength and top machinability, use of Chateaugay results in a high carbon iron, which supplies lubricating qualities so essential in glass molds.

A Republic Pig Iron Metallurgist will be glad to show you how Chateaugay consistently outperforms other pig irons. There's no obligation. Just mail the coupon.

LESS SPACE is required for storing a wide variety of parts when you use Republic Wedge-Lock Steel Shelving. Joints are designed to grow tighter as load increases, permitting higher stacking without distortion or instability. Result is efficient use of floor space plus easy rearrangement to meet changing requirements.

LESS HAZARDOUS lifting operations are the result when the proper type of chain sling is used. Republic can furnish the proper type and accessories for all applications in alloy or high carbon steel, and wrought iron. Because each type has a specific use, we recommend talking over your requirements with a Republic Chain Engineer.

LESS COST per year of service is just one feature of Republic Materials Handling Equipment. Rugged steel construction assures long, efficient service. The complete line includes all types of boxes, skids and pallets. Republic Materials Handling Specialists will work with you in designing special units to meet your specific requirements.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
Dept. C-2259
3132 East 45th Street
Cleveland 27, Ohio

☐ Please have a Pig Iron Metallurgist call.
Send more information on these Republic Products.
☐ Steel Shelving ☐ Chain Slings
☐ Materials Handling Equipment

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

who 'goofed'?

Rough surface — casting rejected! Time and labor a complete loss . . . all because Molder Mike forgot the PARA-SPRAY.

for "shakeout" success use

PARASPRAY

The modern core and mold surface conditioner with two major "built-in" advantages: 1. Deoxidizes mold cavity atmosphere; 2. Stabilizes moisture content.

Try PARASPRAY in your foundry. Discover the easy, economical way to better, smoother castings. Sample on request.

From your distributor or direct.

Para PRODUCTS DIV.
5200 River Road
Washington 16, D. C.

FOUNDRY RUBBER, INC.

Circle 643 on Inquiry Card—Page 201

Readers' Comment

Part of the Training Program

TO THE EDITORS:

We are pleased that you found the Atlantic City presentation of the results of the survey of mechanized foundries interesting and indicating satisfactory progress on our joint problem of advancing training in the foundry industry.

In addition to the findings published in your July issue, p. 94, it might be well to relate the survey to the over-all plan of the industry and the Department of Labor in their attempt to improve skills in the foundries.

The plan roughly covers the following steps:

1. Determining the need for skills and hence for training in the foundries. (The survey of mechanized foundry referred to above is a part of this step. Another survey, that of job foundries, is proposed together with further description of some jobs in order to complete information upon which a judgment will be made by the foundry representatives as to the need.)
2. A determination of the types of training and methods to be used which would be recommended to meet this need.
3. The organizational setup and coordination of the different groups involved necessary to bring this recommended training to the attention of foundrymen and to give whatever assistance may be requested in putting the training into operation.

As you know, Mr. William J. Moore and I have been advocating additional training in foundries for the past few years. During his absence for one year in activities connected with National Security I am carrying on the over-all plan as lead man for the Department of Labor. Upon his proposed return shortly, we shall resume joint activities as before. Mr. John McCauley, chief of research, has done an excellent job on the survey and the presentation of results from our point of view.

R. B. BROWN
Field Representative
U. S. Department of Labor
641 Washington St.
New York 14

* * *

It Takes Considerable Skill

TO THE EDITORS:

Few trades, if any, are less understood by the layman than that of foundryman. It is true that machines have invaded the foundry, especially in the smaller classes of work, and many of these machines require only semiskilled labor. However, perhaps more science and mechanical skill is called for in an all-around foundryman than in any other of the manual trades.

To begin with, the melting of the metal involves problems in higher mathematics. Then the actual molding involves problems in chemical reaction. A high degree of mechanical skill is involved, especially in jobbing foundries, in determining the most economical and practical manner of producing odd castings.

By odd castings I refer to a case where one casting, perhaps, of a somewhat intricate design is called for, where the expense of a complete pattern would be out of the question. I have in mind a casting for a jig which was a plain cylinder about 3 ft long by about 2 ft-6 in. in diameter, with a series of holes for lightening purposes around the periphery.

Two conventional ways to make this casting involved considerable patternmaking. One method would be to make a split pattern lengthwise, and another to split it sidewise. Both methods would involve the making and setting of many cores and at least two weeks' work for a patternmaker, which at today's rates, including the cost of the lumber, would be around $250.

The foundryman, after much thought, conceived the idea of making a core of sand by using the rings which jobbing foundries have for pulley work. A segmental corebox was made with the required holes in it. This segmental corebox was half the length of the job, thus two rows of cores—12 below and 12 above—did the job. And patternmaking was reduced to one day's work.

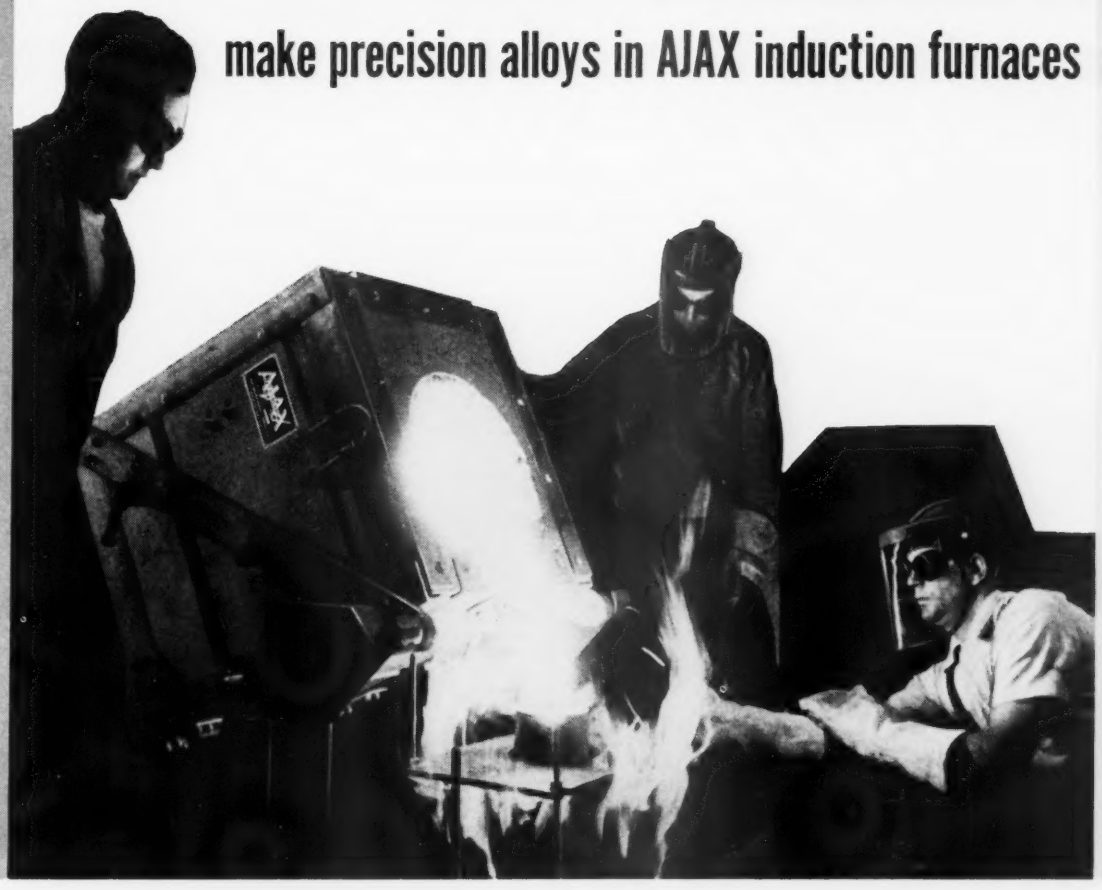
The advent of the automobile and airplane, too, have brought undreamed-of problems to the foundry. Cores for an eight-cylinder automobile block may amount to several score, all to be set with mathematical exactness.

Foundry problems are nothing new, however. We read in the Good Book of the casting of pillars for Solomon's Temple. They were described as being 6 ft in diameter, 27 ft long, and 1 in. thick. The only details given of their making say that they were cast in clay ground, between Succoth and Zarthan.

I fear it was not a molder who described it that way.

E. R. WATERMAN
1101 *Church St.*
San Francisco

make precision alloys in AJAX induction furnaces

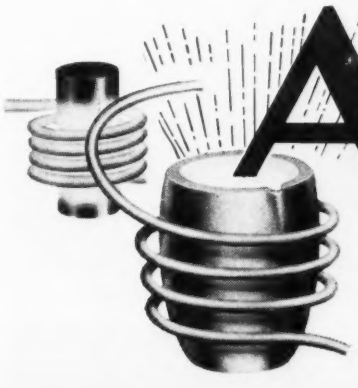


At the Edmore, Michigan, foundry of General Electric's Carboloy Department, all the critical Alnico series of alloys are made in AJAX-NORTHRUP induction furnaces. And you'll find the same choice of equipment wherever precision alloys enter the industrial picture. For the inherent advantages of AJAX induction melting are a perfect match for the uniformity, accuracy, and control required in precision alloying . . . whether ferrous or non-ferrous.

Electromagnetic fields in AJAX-NORTHRUP induction furnaces effectively "stir" the molten metal. Even those elements representing fractions of one per cent of the charge are uniformly distributed throughout the melt. And melting is so fast and clean that you're sure to get out of every melt exactly what you've put into it, subject, of course, to the normal slag problems inherent in the material being melted. There's no chance of contamination, and scrap is almost 100% recoverable. Temperature presents no problem, for both it and melting speed are easily controlled by varying power to the furnace.

For forty years AJAX-NORTHRUP induction heating systems have saved money and improved product quality in every type of installation, ferrous or non-ferrous. Any wonder industry continues to choose AJAX equipment for precision alloying? For details, write Ajax Electrothermic Corporation, Trenton 5, New Jersey.

Associated Companies: Ajax Electric Company—Ajax Electric Furnace Co.—Ajax Engineering Corp.



AJAX NORTHRUP SINCE 1916

INDUCTION HEATING-MELTING

RUGGED!

jolt 'em
Sand retaining flanges won't curl.

sock 'em
Even 60,000 p.s.i. won't stop a Sterling.

pile 'em on
You can stack-mold to a height of 10 sections, or more.

work 'em over
Pour as often as you like.

"sand bag" 'em
No soft spots under sand flange.

squeeze 'em
Sterlings love it!

Sterlings are Built to Take Hard Punishment for Years!

You can operate your foundry at PEAK efficiency if you use Sterling Rolled Steel Channel Flasks. Sterlings are built to withstand hard usage. They have strength where stress is greatest . . . solid rolled flanges with full-width bearing . . . sturdy all-steel webs of 1/4" or 3/8" thickness, containing copper alloy and controlled carbon content . . . solid center reinforcing bars to prevent distortion. Year-in and year-out, they retain their rigidity and accuracy under constant production pressure. Frankly, can you think of any other flask that matches a Sterling for ruggedness?

The new Sterling Catalog is just off the press. For a copy, contact your nearest Sterling representative, or write the factory.

STERLING WHEELBARROW CO.
Main Office and Plant • Milwaukee 14, Wis., U. S. A.
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Subsidiary Company
STERLING FOUNDRY SPECIALTIES, LTD.
London, Bedford and Jarrow-On-Tyne, England

PIONEERS IN THE MANUFACTURE OF FOUNDRY FLASKS

A 8844-1PC

Protect Those Patterns

Are foundries paying enough attention to the problem of protecting themselves against liability for loss of customers' patterns? This question is most important to every foundry using customers' patterns in the production of castings. Failure to take proper precautions and to inform customers of company policy in regard to liability may, in the case of damage through fire or other causes, result in a financial loss so severe as to put the foundry out of business.

The subject of liability for patterns has been considered periodically by the Terms and Conditions of Sale Committee of the Gray Iron Founders' Society, and recently the Insurance Committee of the Non-Ferrous Founders' Society has emphasized the importance of the problem. Studies indicate that unless stated otherwise in the contract, the foundryman is not liable for loss of patterns by fire or other causes, unless he is guilty of negligence. But negligence may be proved if the foundry does not provide proper storage and protection, does not provide the best foundry practice or permits carelessness of an employee.

What can foundry management do about this problem? Experts recommend numerous steps, including the following:

1. Make a careful study of present operations to see if adequate protection against liability is provided.

2. See that a clause is included in the terms and conditions of sale which says the seller is not responsible for loss of or damage to customer's equipment by fire or other casualties beyond the company's control.

3. Send a notice of receipt of patterns which states that the foundry holds the patterns at the risk of the customer. Send the same type of information to owners of patterns held in storage for long periods.

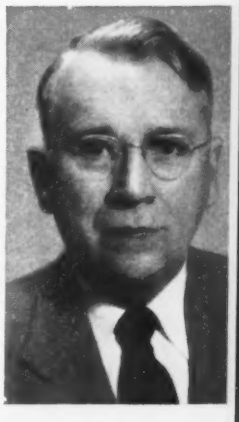
4. Follow good housekeeping and accepted pattern record practices.

5. Consult with the company insurance agent. Have him make recommendations, including the purchase of bailee legal liability coverage.

6. Have the insurance company engineers inspect the plant and make recommendations.

7. Ask your trade association for information on the subject of protection against pattern liability.

Patterns are expensive, and becoming more so all of the time. Why not take proper steps to protect yourself against their loss?

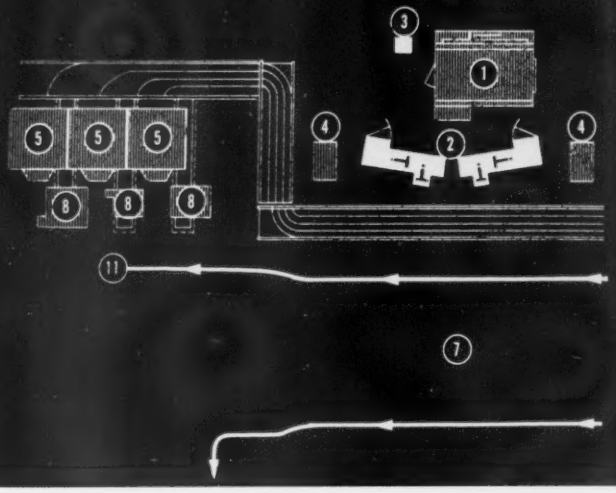


Frank G. Steinebach
Editor

New Permanent Mold Line

Increases Piston Production

At Chrysler Corp., Detroit, a new line of 16 permanent mold machines is turning out half again as many aluminum pistons as the 36 units which it replaced. This article describes operation of the line



By ROBERT H. HERRMANN
Associate Editor

CHRYSLER CORP. has replaced one of two lines of 36 permanent mold piston casting machines at its Highland Park foundry in Detroit with a new line of 16 machines. Capacity of the new line is 46,080 pistons every 24 hr. The retained old line of 36 machines can produce 30,240, making a potential capacity of 76,320 Plymouth, Dodge, DeSoto and Chrysler pistons every 24 hr.

Machines in the new line are completely automatic, hydraulically operated units, each with a capacity of 120 pistons per hour. One man operates two machines, performing the functions of pushing a button to start the machine cycle and pouring the mold when it is closed. Each mold contains two piston cavities, poured simultaneously with a double-lip ladle.

Pistons made on these machines are for Plymouth V-8 and Dodge V-8 engines and contain dimension-controlling flat steel bands. Stacks of the bands are loaded manually into two cylindrical magazines attached to the machine. Weights are placed on top of each stack. A slide mechanism at the bottoms of the cylinders is cycled with the machine and moves one band from the bottom of each stack in position to be picked up by a pivoted arm with finger grippers. The arm swings over the open mold and lowers to deposit the bands on the core wings for each piston.

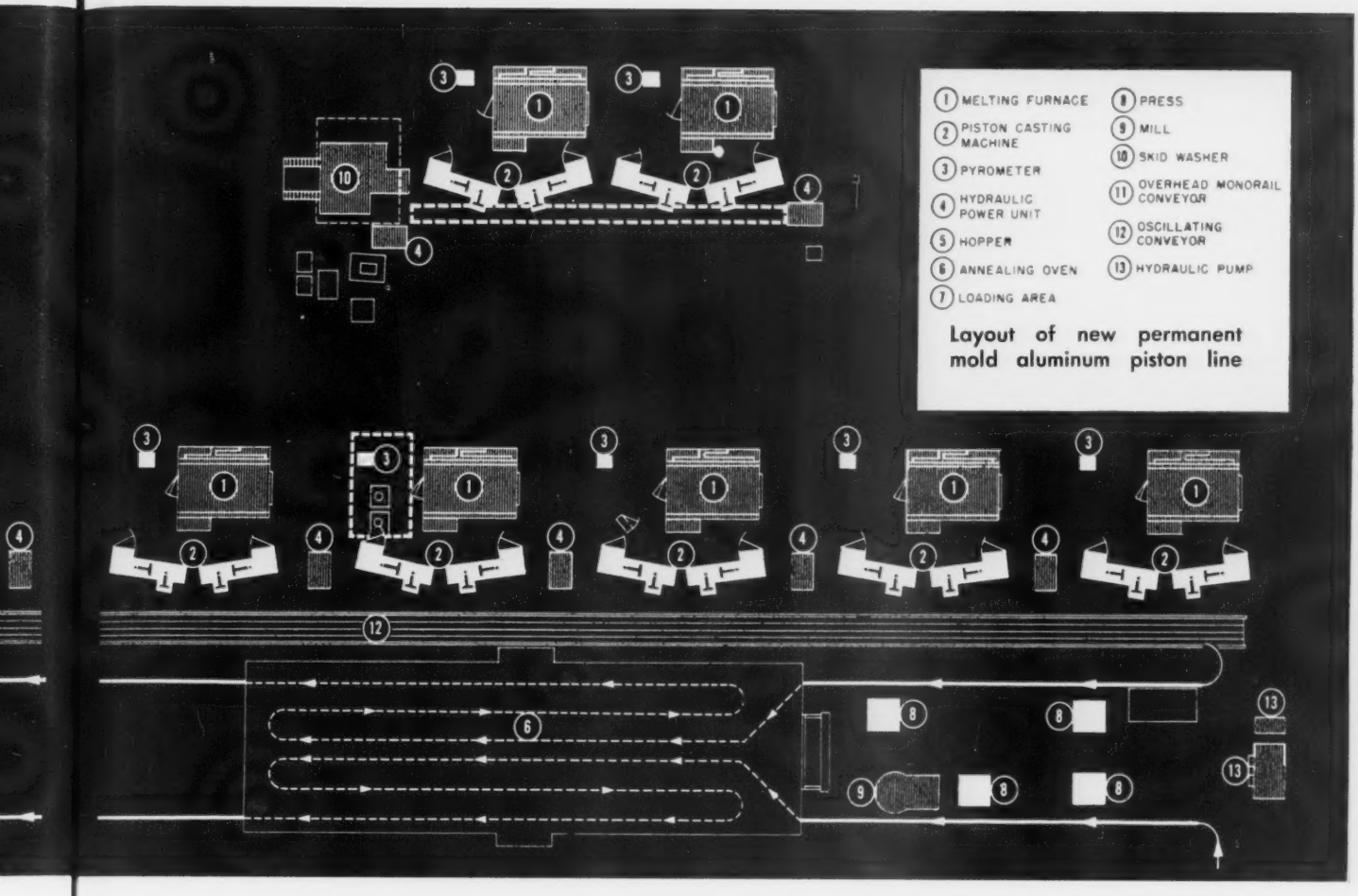
The wings slide out to hold the bands, and the setting arm retracts.

A three-part retractable core raises between the wings; the mold closes and is poured manually with the double-spout ladle. While the metal solidifies, the operator pushes the cycle button on the second machine and pours the molds.

The molds on the first machine open, cores are withdrawn downward and the core wings close. In the meantime a casting-removal arm swings into place over the molds. It lowers and finger grippers grasp the pistons and lift them out of the molds. The arm swings the pistons over a double chute but holds them for a predetermined cooling time before dropping them.

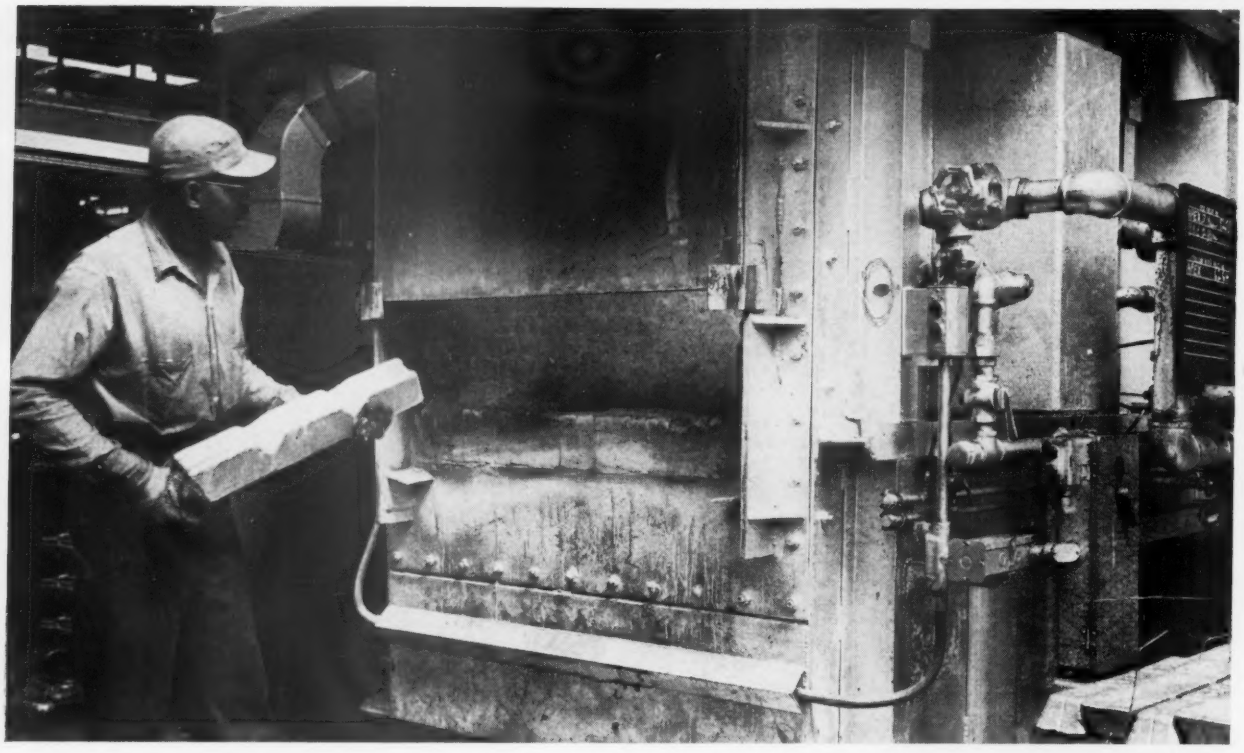
Molds used in the machines are of Meehanite and cores are steel. A system of water cooling keeps the top section of the mold where the steel ring is inserted at 600°F. The lower part of the mold which forms the piston skirt is held around 500°F, depending on piston style. The cores are held at 600°F.

Use Dry Hearth Furnaces — Aluminum alloy used for the pistons is Chrysler's MS 3012, which is similar to Alcoa D132, containing 3.5 per cent Cu, 9 per cent Si and 0.8 per cent Mg. It is melted in eight hooded, gas-fired, dry hearth furnaces at the rate of 900 lb per hr per furnace. Ingot is



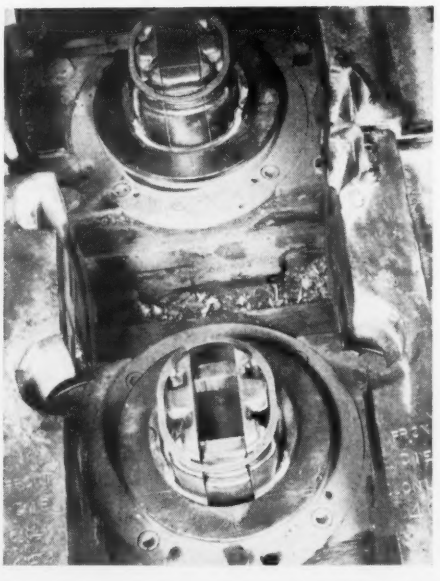
Layout of new permanent mold aluminum piston line

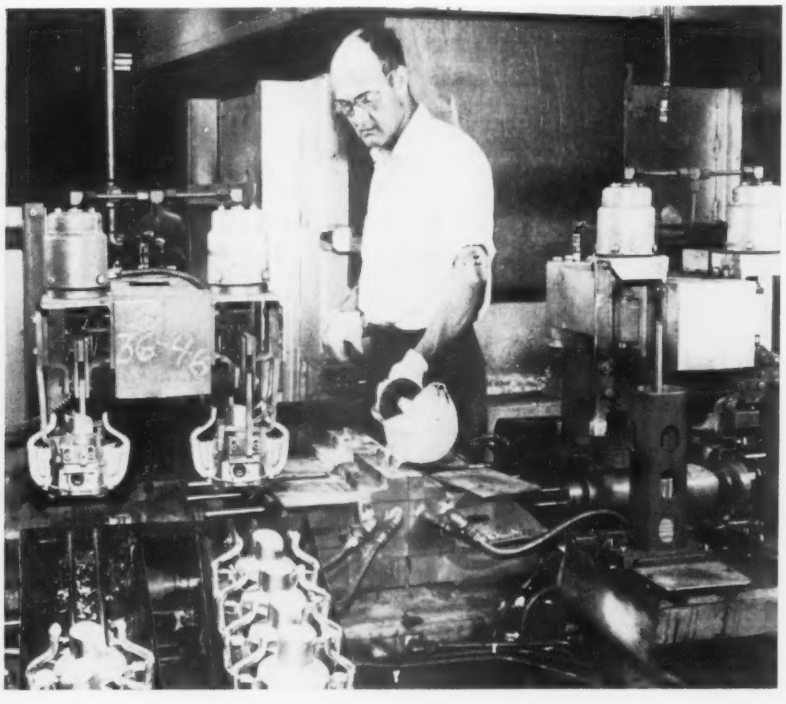
Aluminum alloy for piston production is melted in dry hearth furnaces. Each furnace supplies metal to two of the 16 new permanent mold machines



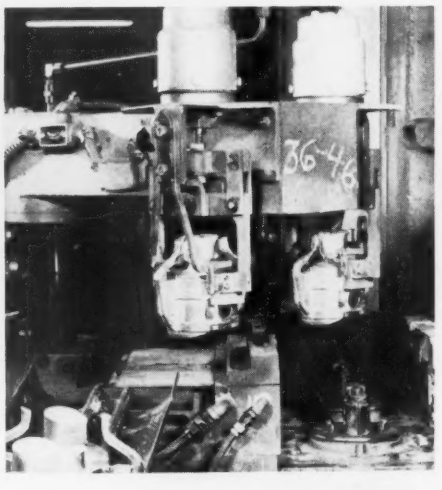
Ingot is charged onto sloping hearths of furnaces. Molten aluminum runs through opening to holding bath at other side of furnace

Illustration shows steel bands which control dimensions. They are in place around the core wings and the three-part rectractable core





Molds are poured with double-spout ladle. Previously poured pistons cool while held through one machine cycle by swing-out arms



Three-part core is retracted and mold wings closed (lower right) to permit easy withdrawal of pistons by grippers on swinging arm

loaded onto the sloping, 14-sq-ft hearth and melted at 1650-1700°F. Molten metal runs through an opening to the 2700-lb capacity holding section of the furnace. Holding and pouring temperature ranges between 1240 and 1280°F, depending upon piston style, and is maintained at ±5°F. Metal is hand-ladled from side wells on the furnace for pouring the molds. Each furnace supplies two machines on the new line.

When pistons have cooled sufficiently to be released by the pickup arms, they slide down two chutes from each machine to a reinforced wire-mesh, chain-driven belt conveyor. Exhaust hoods over the conveyor cool the pistons for handling and facilitate rapid chilling to improve their heat-treatability. Plate steel guides mounted above the belt form three longitudinal channels, permitting three types of pistons to be segregated and transported simultaneously. The conveyor runs behind the line of machines and feeds a cross belt which discharges onto an inclined belt. Castings are kept separated on all changes and are plowed off the elevated belt to chutes leading to three bins.

Operators at power shears beside each bin remove gates and risers. Apron conveyors under each shear carry gating metal to a fourth apron conveyor which discharges into a tote box. Box-loads are trucked to the furnace area. Gates and risers are charged directly into the furnaces.

Shear operators place pistons on shelves of an overhead monorail conveyor, which carries them through a heat-treating furnace for precipitation hardening. The treating cycle is 4 hr at 425°F.

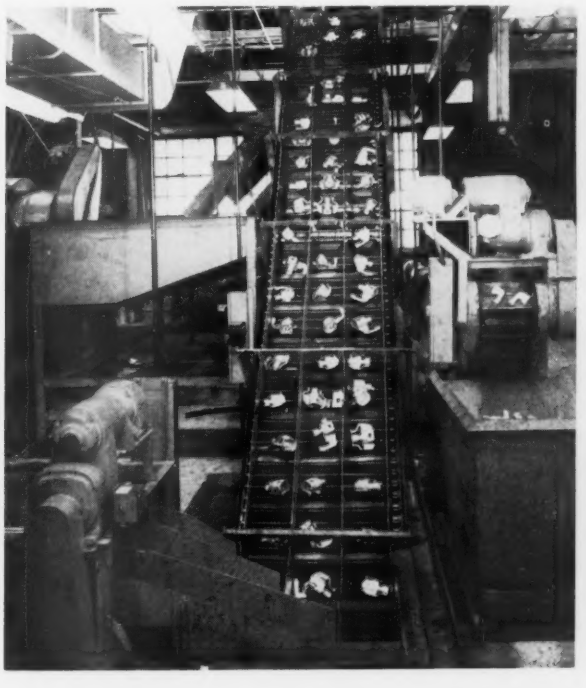
Production Is Lower on Old Line — Chrysler, DeSoto and six-cylinder Plymouth pistons are cast on a 36-machine line retained from the old foundry installation. The mold halves and center core on these machines are moved hydraulically but the core wings are opened and closed by hand levers. Each machine produces one piston per cycle, and one man operates two machines. Capacity per machine for six-cylinder Plymouth pistons is 35 per hr. For DeSotos it is 37, and for Chryslers it is 30. Nine gas-fired, reverberatory furnaces furnish metal for these machines.

Pistons from this line are set on shelves of an overhead monorail conveyor for movement to the gate removal area. At this point, also, the heads on six-cylinder Plymouth pistons are milled. All pistons are placed back on the conveyor shelves for transport through the same heat-treating furnace, servicing the conveyor from the new line.

After heat treatment, pistons are unloaded manually from the conveyors, visually inspected and stacked in wire tote boxes. Six-cylinder Plymouth pistons are shipped directly to the engine plant for machining and all others go to the machining department in the Highland Park plant for rough turning of the heads and sides.

Chrysler's quality control program includes weight and dimensional checks performed twice a shift on three pistons from every casting machine. Metal analyses and piston x-ray examinations are performed at least once a day. Because weights of

Pistons moving on divided wire belt conveyor are cooled by passing under a row of exhaust ducts



Pistons are being elevated to storage bins. They are kept segregated during transfer on conveyors

After they have been heat treated, the pistons are unloaded from mono-rail conveyor carriers, visually inspected and loaded in wire tote boxes

Operators take the pistons from chutes at the bottoms of the storage bins and place them on power shears for removal of gates and risers

Scrap pistons which contain steel inserts are melted in a dry hearth furnace. Inserts then are raked off the hearth to a bucket as shown

these pistons are very important, they must fall within a narrow range. Weights of the rough machine pistons are checked in grams. Converted to ounces they are: Plymouth V-8, 22.93 to 23.88 oz; Plymouth six, 20.04 to 20.49 oz; small Dodge V-8, 20.00 to 20.56 oz; large Dodge V-8, 21.34 to 21.94 oz; Chrysler, 28.82 to 29.35 oz and DeSoto, 24.04 to 24.65 oz.

Metal Recovery — Scrap pistons containing steel inserts, floor sweepings and skimmings are melted in a hooded dry hearth furnace at the rate of 2000 lb per hr. The steel inserts are raked off the dry hearth to a bucket and scrapped. Molten aluminum flows from the furnace into an ingot mold conveyor about 30 ft long. It passes under an exhaust hood and dumps ingots into a tote box. Ingots in each heat are marked and held until a laboratory analysis of the metal is made.

Turnings from the machining of pistons in this and other Chrysler plants amount to 20,000 lb every 24 hr. They are returned to this foundry for remelting. First they are dumped onto an inclined apron conveyor which deposits them in a 10-cu-ft capacity hopper. A swinging chute at the bottom of the hopper feeds them into two centrifuging machines where chips are washed with room temperature water, then with steam at 90 psi to reduce oil content to about 2 per cent.

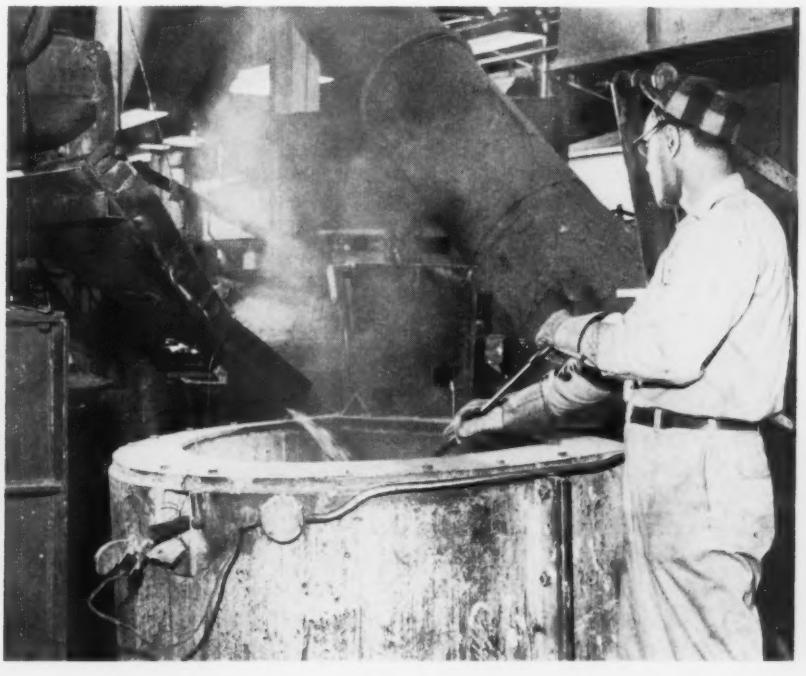
A vacuum pipe is used to transport chips from the washing machines to an accumulator, then into a rotary, gas-fired drier. From the drier, chips are raised by bucket elevator to a vibrating screen which holds everything above 30-mesh size. Recovery operations are not feasible for the smaller turnings. The larger material comes off the screen and over a magnetic separator to remove iron particles. The dry, iron-free chips represent about 77 per cent by weight of the original turnings, and are raised by bucket elevator to two bins of 10,000-lb capacity each.

Vibrating feeders at the bottoms of the bins feed chips to two induction melting furnaces at the rate of 800 lb per hr—the melting rate of the furnaces. In this way, less oxidation loss occurs. Each of the furnaces has a capacity of about 1800 lb, and each batch is fluxed with a chloride-fluoride-base flux. Fumes given off in the process are treated in a wet collector. The same collector handles exhaust from the rotary drying furnace to remove aluminum dust from the exhaust.

The aluminum dust forms a sludge on the collector bottom and is removed by a drag link conveyor to a tote box. Chlorine and fluorine, present in the flux fumes, are soluble in water, and the acids formed end up in the water tank of the wet collector. A large volume of clear water is passed through the tank over a system of agitating baffles, thus diluting and carrying off the acids.

Dross from the chip remelting furnaces is raked into refractory-lined buggies having a tap hole in the bottom. Buggies are wheeled under an exhaust hood and the contents rabbled. Molten metal which settles to the bottom is tapped into an ingot mold and charged back into the furnaces for further refining before being poured into piston ingot.

A skip hoist and an inclined apron conveyor carry turnings to a 10-cu-ft storage hopper



Hopper feeds turnings to centrifuging machines for cleaning. They then go to storage bins from which they are fed to induction melting furnaces at the melting rate of the furnaces, to minimize oxidation loss

Patterns for Torpedo Tubes

Making patterns for submarine torpedo tubes to be cast centrifugally is a tough job. Here's how close co-operation between research, design, pattern shop and foundry simplified the job

By RICHARD J. PORTER
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Groton, Conn.

TORPEDO tubes for submarines are, in foundry terms, nonferrous cylinders with multithickness walls, pads, bosses and cored sections. Static casting of these tubes presents problems enough, but making patterns to cast them centrifugally calls for careful advance design and planning work.

Development of specialized pattern equipment to meet the rigid requirements of this process contributes much to the final success of the project. It insures that strict concentricity, definite compensation for static and dynamic balance, and provision for longitudinal shrinkage are provided without variation.

To illustrate the problem, Fig. 1 shows one of the three castings which are assembled to make a full-length tube. These are cast in a dry sand mold rotated on the horizontal axis.

Originally the tubes were cast statically, on end, with a ring riser 14 in. high with pouring basin and down gates as shown in Fig. 2 and described on page 177 of Pat Dwyer's book *Gates and Risers*. This method required a split pattern, many loose pieces and a heavy corebox. Present practice makes use of simpler and more compact pattern equipment to obtain good casting results.

How It Is Done—Each mold is made in three special steel flasks which carry the running and locking rings necessary for the centrifugal casting phase of the operation. The controlling factor as far as the pattern work is concerned is the 34-in. length of each flask section.

The basic pattern body for all molds made in these flasks is a hexagonal steel weldment 18 in. across the flats, accurately centered on a cast iron mold plate, Fig. 3, on which the flasks are indexed so that each section of flask will be exactly related to each other. At the start of the project, several of these hex centers were made to minus zero, plus 0.003-in. tolerance with all necessary dowel and pin holes jig-drilled so that work could progress simultaneously on new patterns, layout of pads, checking and production of molds.

On this standard body all patterns are constructed in sets of six loose slabs, each of which is held against the surface by two tee-handled dowels threaded at the ends, Fig. 4E. They are applied from the inside of the hex to secure or loosen the slabs as required. Thus, the mold is formed by placing a set of slabs on the hex, ramming the mold, loosening the slabs and withdrawing the mold plate with the attached hex. This procedure allows three master drafted slabs to be drawn in first to release the other three. Fig. 5 shows a mold half rammed, and Fig. 6 shows a completed section.

Slabs Are Interchangeable—Once this standard flask equipment, molding procedure and type of pattern had been agreed upon by the development engineer, the foundry and the pattern shop, equipment was designed in the pattern shop to insure that slab sets would be interchangeable and reproduceable.

To anchor the slabs to the hex it was decided to use a No. 3 master rapping plate with the draw hole tapped out to fit the threaded dowels. This tapping, done on a screw machine, is held as close as possible to the rough-cast outside diameter. The plate recess is routed in the back of the slab with an electric router and the fixture shown as A in Fig. 8. To maintain the exact center distance a gage shown as B is used. From then on, all work on the slabs is referenced from these plate centers.

The slabs, which are stripped up of mahogany, are rough-planed close to size and placed in fixtures indexed and secured from the master plates where the edges are milled to the proper angles. Depending on the anticipated use of each section, they may or may not have $\frac{1}{16}$-in. sheet brass

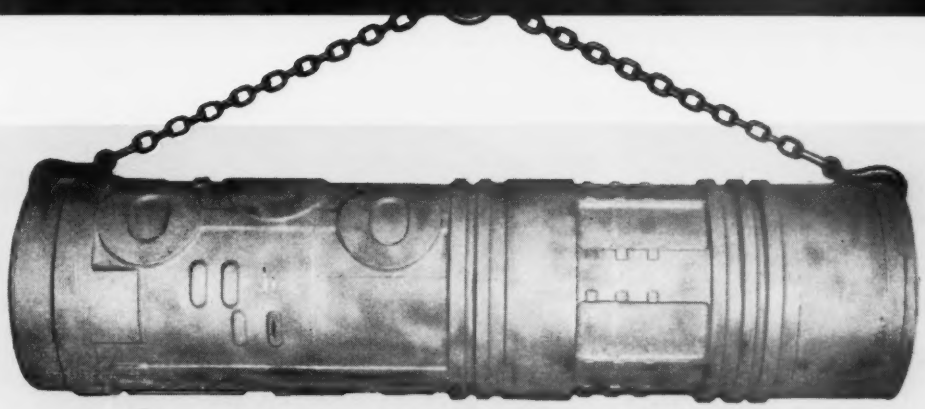


Fig. 1 — One of the three castings which are assembled to produce a full-length submarine torpedo tube

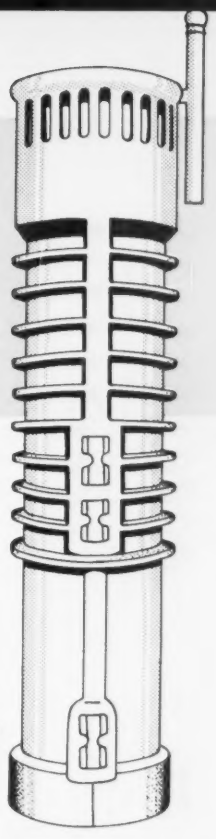


Fig. 2—Tubes originally were cast statically, on end, with down gates and ring riser, as shown in sketch

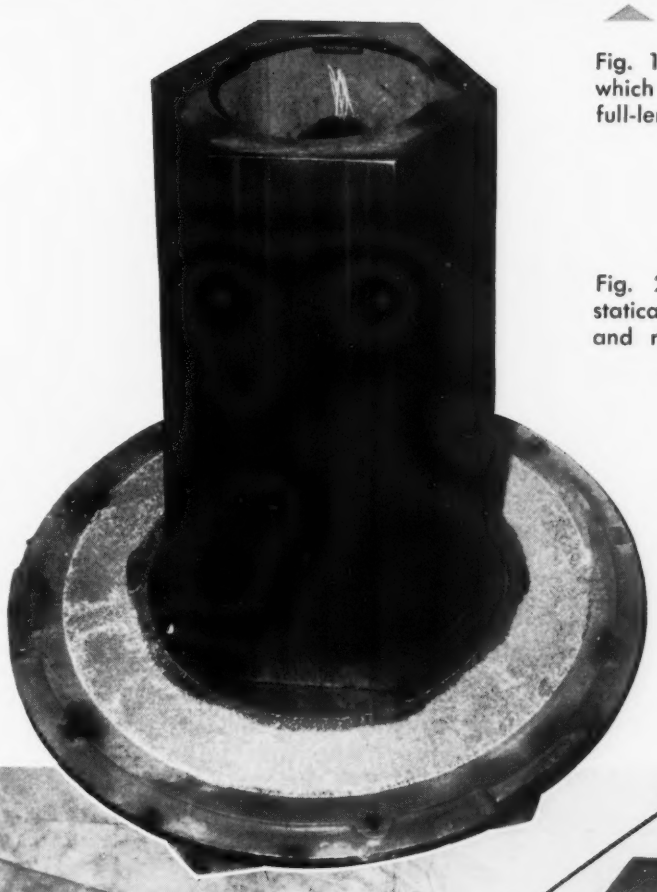


Fig. 3—Basic pattern body for all molds is this hexagonal steel weldment centered on a mold plate

Fig. 4—All patterns are constructed in sets of six loose slabs. Each set has own carrying box

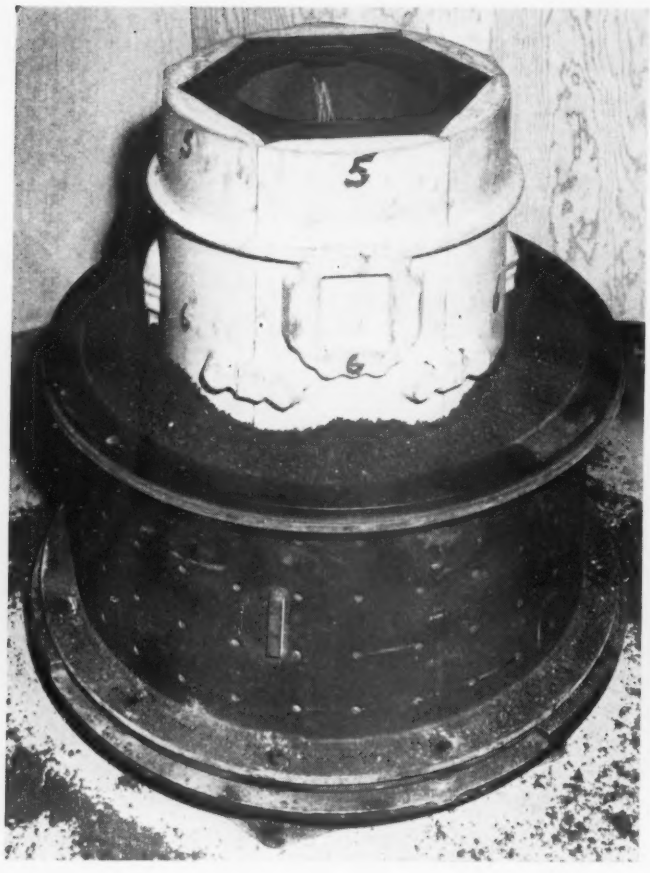


Fig. 5 (left)—This shows a mold half rammed. Note how the slabs are grouped around the hexagonal member. Fig. 6 shows a completed section

wearing strips applied to the back prior to this operation.

A set of slabs then is mounted on one of the hex bodies fitted with centered end plates, placed in a lathe and turned in the regular manner. Heavy rings of wood segments or thin ribs of cast aluminum are set in and turned just as they would be on any split job. Because of the weight of this assembly and the speed at which it turns, a ball-bearing live tail center is used.

Slab sets of the turned assembly are transferred to a layout fixture with indexed end plates, Fig. 7, where all centers are laid out for pads and bosses. Stock for pads is prepared in a fixture consisting of a portable electric router hung on an overhead shaft to swing on a radius equal to the outside diameter of the tube. Draft on pads must be figured 90 degrees from the back of each slab. However, a uniform 15 degree angle takes care of all except those on the extreme edges which are drafted to suit. Plastic wood has proved satisfactory for the large fillets required.

Each set of slabs has its own carrying box for protection in transit and shortage, Fig. 4, and, because three sets are required end to end in proper sequence to make a complete mold, the flask section numbers are painted plainly on each slab. To get good detail on the pattern number, a fine sand core is made in a separate box and pasted in the recess provided by the print as is indicated by C in Fig. 4.

Use True Centrifugal Process—In the true centrifugal casting process, the amount of metal poured into the mold governs the wall thickness and finish allowance for the inside diameter of the casting. No internal core is required. The metal is introduced into the mold while it is spinning, picked up by the mold surface and forced against the mold area by centrifugal force equal to about 100 psi. It thus becomes a problem to make certain that this rapidly revolving heavy mass, containing 4000 lb of liquid metal, is in perfect balance.

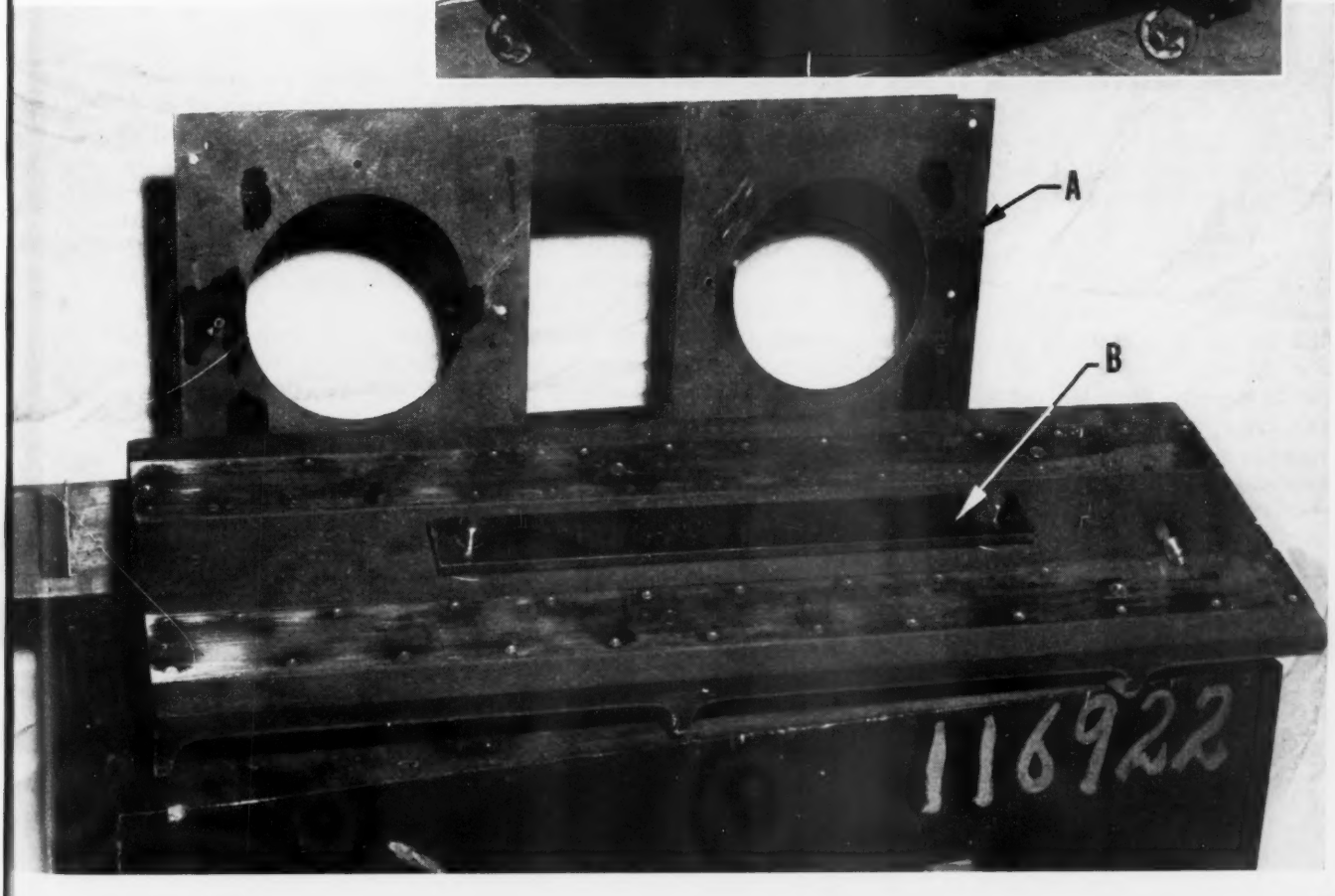
To achieve this condition, all factors introduced into the pattern on the pads and bosses affect the calculations. The amount of finish, draft and fillets is included in determining the volume and angularity of all off-center weights in order to calculate the value and location of the necessary counterweights for static and dynamic balance. These compensating masses then become part of the pattern by being attached at one or both ends as necessary in areas where they will be cut off in the normal machining operations, Fig. 4D. The large amount of draft allowed on pads and ribs helps to relieve longitudal stresses during contraction. The diameter shrinks almost $\frac{3}{8}$-in., and sections with large fillets withdraw from the mold surface enough to provide considerable latitude endwise on the contract layer

of the mold, which already is beginning to disintegrate from the heat.

The outstanding feature of this job is that it originated as a relatively short run proposition to meet a need for a type of casting not available from any other source. The fact that the first casting made was perfect and that this record was continued uninterruptedly over a long period of years shows the value of the close co-operation between research, design, pattern shop and foundry that went into this equipment during the preliminary stages. Not many pattern shops will be called upon for this type of work, but the principle of the basic body with removable sections can be applied to many other types of work. In fact it has been adapted for centrifugal casting of gear rack sections and smooth-walled tubes within the diameter range of the equipment.

Fig. 7 — Layout fixture with indexed end plates where centers are laid out for pads and bosses

Fig. 8 — Fixture used in routing out slab recess for master rapping plate



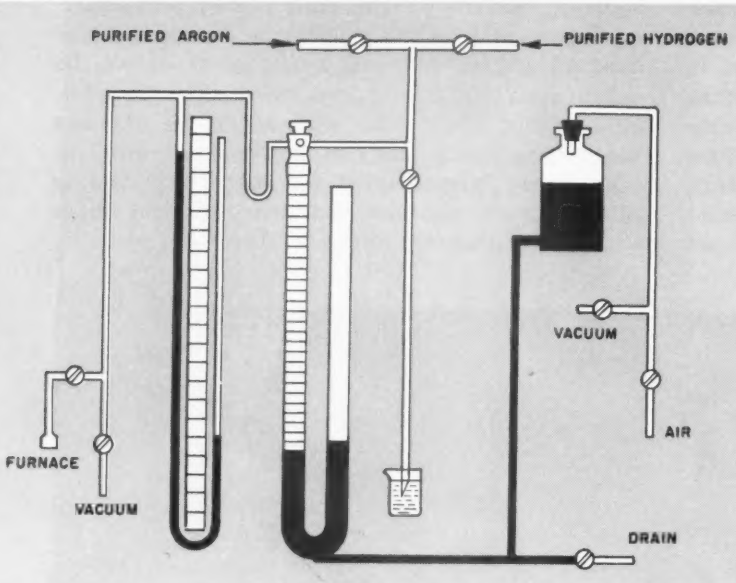


Fig. 1—Apparatus of Sievert type has yielded much information on the solubility of gas[1,2]

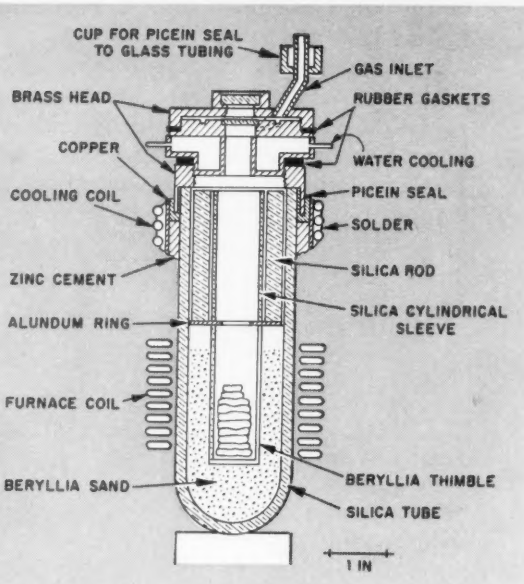


Fig. 2—This type of furnace assembly is used to measure solubility of gas in molten metals[2]

Gases in Iron

Gases in metal cause a great deal of trouble. This article is a review of the behavior of various gases in metals and deals largely with mechanisms by which gases get into and come out of metals

GASES in metal cause a great deal of trouble. Some, like hydrogen, seem to create nothing but problems, whereas others, like nitrogen, may be undesirable for many purposes, but highly desirable for others. This paper is a review of the behavior of gases in metals and deals largely with the mechanisms by which gases get into and come out of metals.

Solubility—To cause trouble in a metal, gas must dissolve in it. The inert gases do not dissolve and therefore cause no difficulty. Instead, they can be used to flush out other, unwanted gases or, like argon and helium, can be used as protective atmospheres on small melting units to exclude unwanted gases.

Our concern is with gases most likely to get into metals during reduction from the ore, refining of molten metal and reheating of liquid or solid metal. These common gases may be classified as follows: Elemental diatomic gases — H_2, N_2, O_2; other diatomic gases — CO; and triatomic gases — SO_2, H_2O, H_2S, CO_2. When these gases come into contact with metals and dissolve, they do so according to certain laws. A good deal is known about these laws.

Much of the information on solubilities and the laws of solubility has been obtained from apparatus of the Sievert type[1, 2] (Fig. 1). When the metal worked with is solid, the sample is sealed up in a glass or quartz tube attached to the tube marked "Furnace" in the illustration. The sample tube is surrounded by a furnace controlled at the desired

TABLE I—Mechanism of Solution of Simple Diatomic Gases

In Water	In Metals
$X_2(gas) \rightarrow X_2$ (molecules in solution)	$X_2(gas) \rightarrow X + X$ (atoms in solution)
$\frac{a_{X_2}}{p_{X_2}} = k$ law of mass action	$\frac{(a_X)^2}{p_{X_2}} = k$
$\%X_2$ (in solution) $= K p_{X_2}$	$\%X$ (in solution) $= K\sqrt{p_{X_2}}$ ←Sievert's Law
Solubility decreases with temperature	Solubility increases with temperature

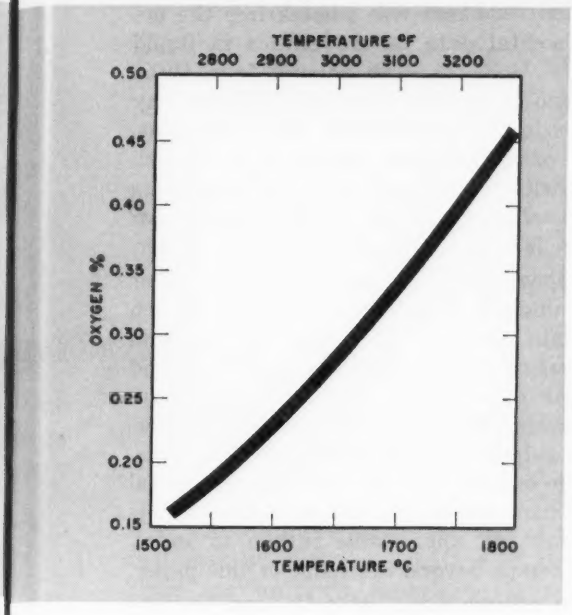


Fig. 3—Diagram illustrates the considerable solubility of oxygen in pure liquid iron[4,5,15]

and Steel

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School of Chemical and Metallurgical Engineering
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temperature. The whole apparatus is evacuated and the apparatus is filled with argon to measure the volume not occupied by the specimen.

After this measurement has been made, the system is re-evacuated, and gas being studied (for example, hydrogen) is admitted and allowed to come to equilibrium. The difference between the volumes of hydrogen and argon required gives the amount of hydrogen dissolved in the metal. With a liquid metal, the simple sample tube with resistance furnace is replaced by the arrangement shown in Fig. 2, in which the sample can be kept at the desired temperature with an induction furnace.[2] Both arrangements are used in research at Purdue.

Elemental Diatomic Gases—Since foundrymen are most concerned about gases that dissolve in molten metals, this discussion of solubility laws will deal mainly with their applications to liquid metals, although the same or similar laws often apply equally to many solid metals over wide temperature ranges.

The solubility laws of elemental diatomic gases in metals and how they differ from the solubility laws of gases in water are demonstrated in Table I. Such a gas dissolves in water as a molecule, but breaks up in a metal and goes into solution as atoms. Reference to the law of mass action shows why the amount dissolving in water is proportional to the partial pressure. It also shows why the amount dissolving in a metal is proportional to the square root of the partial pressure.

This last statement (see Table I) is known as Sievert's Law. The solubility of gases in water decreases with higher temperature, but in metals the behavior is just the opposite. For a molecule of a gas to dissolve as atoms, it must be torn apart, and this action takes energy. The higher the temperature, the more easily this energy is provided. Thus the mechanism of the solution of a gas in a metal is in the nature of a chemical reaction.

Table II illustrates this mechanism more completely for elemental diatomic gases. The Sievert's Law constants have been determined at various temperatures for many metal-gas combinations.[3, 4, 5, 6] These solubility data for liquid iron are expressed in a concentrated form in column four. The lower part of the table shows how the solubility of a simple diatomic gas in liquid iron may be calculated from these data. Part of this information also is available in graphic form in a few modern texts.

Other Diatomic Gases—The solubility laws for other diatomic gases are illustrated by Table III. When carbon monoxide comes into contact with a hot metal, it tends to go into solution as carbon atoms and oxygen atoms and thus to put carbon and oxygen into the metal. Again, solubility increases with temperature. Heat is required to "tear the atoms apart," and, as before, the mechanism has the characteristics of a chemical reaction.

The solubility in liquid iron has been studied and may be calculated from columns three and four in Table III for any set of conditions. As in the case of the elemental diatomic gases, a lowering of metal temperature or partial pressure of the gas over the metal causes it to come out of solution again. Note that the law states that under any constant partial pressure of carbon monoxide, the product of the carbon content of the metal and the oxygen content of the metal is a constant.

Triatomic Gases—The laws for common triatomic gases are illustrated in Table IV. These gases also tend to break up, and their constituent elements

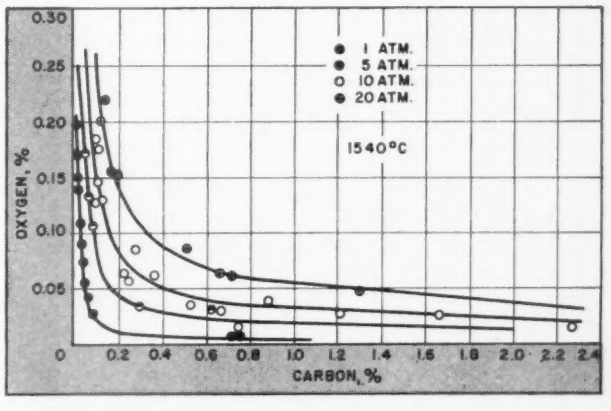


Fig. 4—Illustrating the carbon-oxygen equilibrium in liquid iron at various CO pressures[3,9]

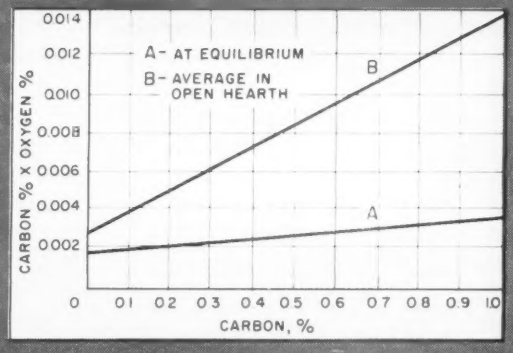


Fig. 5—Diagram showing carbon-oxygen product at 1 atmosphere and at about 1500°C[8]

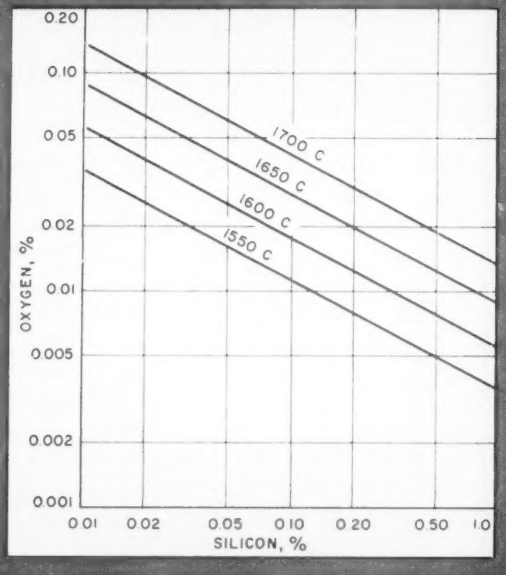
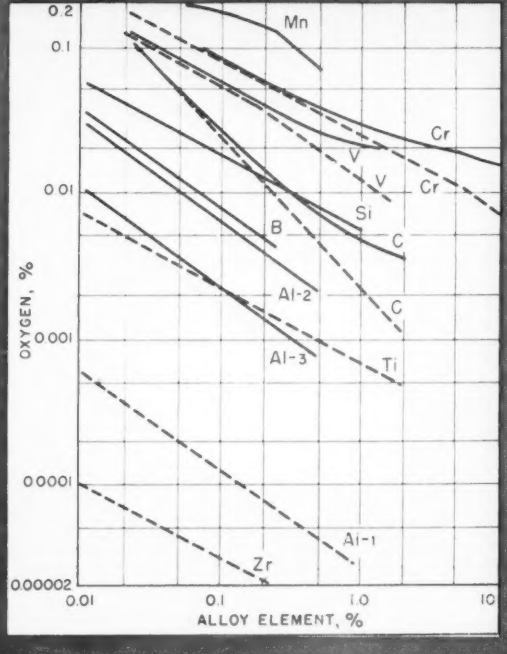


Fig. 6—Deoxidation diagram for silicon shows compositions in equilibrium with pure SiO_2[3]

Fig. 7—Chart summarizes the relative deoxidizing power of various other deoxidizers[3]



go into solution. Column five summarizes the accepted experimental data on solubilities in liquid iron.[3, 7, 9, 10, 11, 12, 13] With column four, these data enable one to calculate the solubility of any of these gases in liquid iron under any conditions.

Solubilities of all of these gases increase with temperature, with the exception of SO_2—and its temperature coefficient is small. The reason for this exception is beyond the scope of this paper.

Table IV shows why the passage of water vapor over a pure liquid metal tends to put both hydrogen and oxygen into solution. This reaction accounts for a good deal of the hydrogen in liquid iron and steel. Sulphur dioxide dissolves as sulphur and oxygen, a process which accounts for sulphur pick-up from high sulphur fuel in open-hearth furnaces. Carbon dioxide oxidizes both liquid and solid metal by the mechanism shown. It seldom is responsible for contributing any appreciable carbon to metal, for reasons perhaps beyond the scope of this paper.

The data in column five, Table IV, can be used to calculate many interesting things.[6] For example, if we consider a bath of molten steel containing 0.05 per cent S and 0.02 per cent O, this sulphur and oxygen would be in equilibrium with SO_2 at a partial pressure of 2×10^{-8} atmospheres. Thus, such a bath is capable of taking up sulphur from a furnace atmosphere containing as little as 0.02 part per million of SO_2 by volume—and hence practically all the sulphur in the atmosphere of an open-hearth furnace.

It also can be demonstrated that passing water vapor at 0.1-atmosphere pressure over liquid iron at 1600°C eventually will lead to the taking up of 0.0027 per cent hydrogen and 0.025 per cent oxygen.[11] This amount is just as much hydrogen as the iron would take up from pure hydrogen; no wonder, then, hydrogen often appears in finished steel in serious amounts. *The volume of gas which metals dissolve is considerable although the weight percentage may be small.*

An undeoxidized steel of 0.20 per cent carbon in the furnace is likely to contain 0.02 per cent oxygen. Since this oxygen content is several times the volume of the steel, the product would be a sponge if even a small fraction came out.

Just above the freezing point of iron, H_2 and N_2 at 1-atmosphere pressure can dissolve in iron to the extent of 2.4 volumes at normal temperature and pressure per volume of metal, or 15 volumes of hot gas per volume of molten iron. On freezing, the solubility may fall to a third of this amount. Thus it is not hard to visualize possibilities for porosity in a finished product. The situation with hydrogen in copper is similar.[14] The amount that can dissolve has several times the volume of the liquid copper, and the solubility in the solid is less than half the amount in the liquid.

Oxygen—Although the mechanism of solution of 7 different gases has been considered, only 5 different elements (oxygen, nitrogen, hydrogen, carbon and sulphur) are involved after solution has taken place. Since the control of C and S are familiar to most people, it probably is most worthwhile to discuss only O, N, and H in a paper of this

TABLE II—Mechanism of Solution of Simple Diatomic Gases in Metals

Gas	Mechanism	Sievert's Law	Temperature Effect in Liquid Iron
H_2	$H_2(g) = 2H$	$\%H = K\sqrt{p_{H_2}}$	$\log K = \frac{-1670}{T} - 1.68$
N_2	$N_2(g) = 2N$	$\%N = K\sqrt{p_{N_2}}$	$\log K = \frac{-563}{T} - 1.10$
O_2	$O_2(g) = 2O$	Law of no use—O_2 pressures immeasurably low	$\log \%O = \frac{-6320}{T} + 2.734$

Example of Use of These Laws and Data

Calculate solubility of hydrogen at 1-atmosphere pressure in iron at 1600° C

$$\log K = \frac{-1670}{1873} - 1.68$$

$$\%H = 0.0027\sqrt{1 \text{ atmosphere}} = 0.0027 \text{ (answer)}$$

Therefore $K = 0.0027$

kind. Accordingly, the remainder of the paper will deal mainly with the behavior of these elements. Since the author's experience is mainly in the ferrous field, their behavior in iron and steel will be the main consideration.

Oxygen dissolves in iron in considerable quantity [4, 5, 15] (Fig. 3). The 0.23 per cent which dissolves at 1600°C is very much more than is found in steel. The solubility in undeoxidized liquid steel mainly is controlled by the carbon content. Hence Fig. 4, the carbon-oxygen equilibrium diagram, gives an approximation of the equilibrium solubility. [3, 9] The figure demonstrates that very low carbon liquid steels are very high in oxygen and that liquid pig iron, or foundry iron, with its 3.5-4.5 per cent carbon has exceedingly low equilibrium solubility for oxygen. It is possible for steel (or iron exposed to oxidizing conditions) to contain more than this equilibrium amount—a supersaturation—under some conditions[3] (Fig. 5). For example, although the equilibrium oxygen content of 0.20 per cent carbon steel at 1500°C is 0.01 per cent, the actual oxygen content in the open-hearth furnace is about 0.02 per cent. In any case, if this oxygen content is not reduced considerably before the steel freezes, the product will be gassy and porous due to the reversal of the carbon-oxygen reaction on cooling (see Table III) and the consequent rejection of carbon monoxide. In steelmaking, the oxygen is controlled with deoxidizers, of which silicon is a common example [3, 16, 17, 18, 19] (Fig. 6). The silicon reacts with the oxygen, forming silica which tends to float to the surface and to escape. Fig. 6 indicates, that even a considerable percentage of silicon does not remove all the oxygen, although 0.2-0.3 per cent generally is adequate to prevent gassiness due to reversal of the carbon-oxygen reaction. Stronger deoxidizers often are used for special purposes. Fig. 7 illustrates the relative deoxidizing power of other deoxidizers.[3] It may be observed that uncertainties still exist regarding the deoxidizing power of some of these elements. In general, we know how to prevent porosity due to oxygen, and producers with good technique can make reasonably clean steel. No one yet has found a way, however, to make commercial steel completely free of deoxidation products in the form of nonmetallic inclusions.

Nitrogen—The solubility of nitrogen in iron is shown in Fig. 8.[15, 33, 35, 36] A sharp drop in solubility on freezing accounts for the porosity in ingots or castings poured from liquid metal very high in nitrogen. Nitrogen in liquid basic open-hearth steels[15] generally ranges from 0.004 to 0.005 per cent and in basic electric arc steels from 0.006 to 0.014 per cent. Nitrogen does not appear to cause much porosity trouble in these steels when they are rolled or forged enough to weld up any porosity that does occur. There is a strong suspicion that nitrogen may be responsible for some of the center-axis porosity often found in large forging ingots which receive only about a 2.5 to 1 reduction in forging. One would expect many heavy castings to show this porosity, too, if carefully examined. Although the nitrogen contents specified above may not appear high at first glance, some of the figures for basic electric begin to look dangerously high when one takes into consideration the tendency of nitrogen to segregate.

Conventional acid bessemer steel at the end

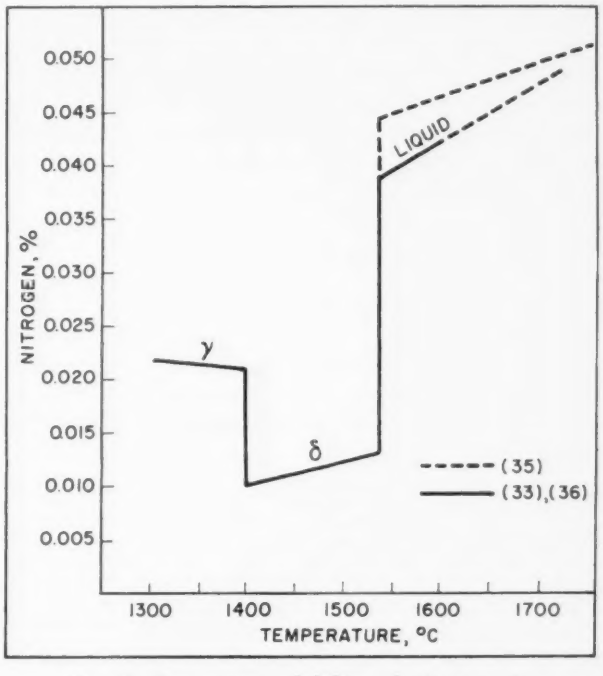


Fig. 8—Illustrating solubility of nitrogen in iron at one atmosphere pressure[15,33,35,36]

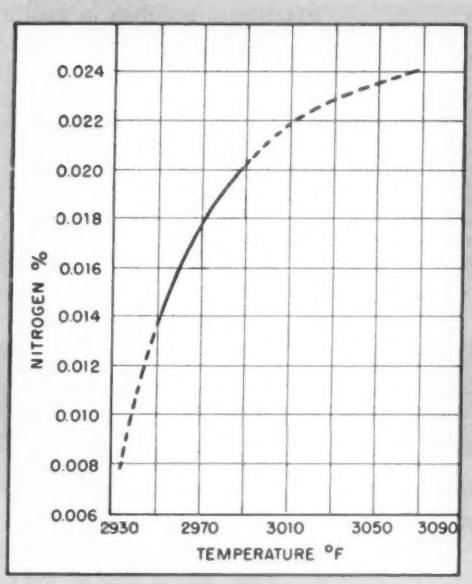


Fig. 9—Showing relation of nitrogen content to temperature in finished bessemer blow[15,20]

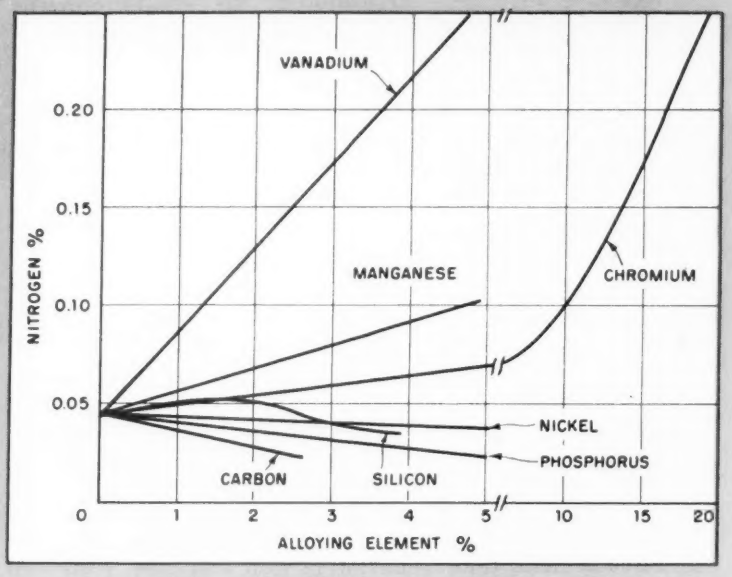


Fig. 10—Nitrogen solubility in binary liquid iron alloys at 2910°F and 1 atmosphere[15,3,21]

of the blow may run 0.008 to 0.020 per cent nitrogen[15] unless special measures are adopted. This figure is high enough to make ingots that would be considered unsound for some purposes and to have a hardening and embrittling effect which makes the steel undesirable for some purposes, but highly esteemed for others. Because bessemer steelmakers are able to control nitrogen content today by various methods, the disadvantages of bessemer steel for many purposes largely can be eliminated. One method is by holding down the temperature of the blow. The effect of this step is illustrated by Fig. 9 [15, 20].

Denitrification with zirconium and titanium precipitates the nitrogen as nitrides of these elements.[3] So far this process appears to have had rather limited application for various practical reasons. The mechanism is not understood quantitatively.

Alloying elements which have an affinity for nitrogen and form soluble nitrides greatly increase the solubility of nitrogen in steels [15, 3, 21] (see Fig. 10). This effect has been utilized to make special high-nitrogen stainless steels. It is found that 2 to 4 per cent nickel in 18-8 type stainless steels can be replaced by 0.1 per cent nitrogen and that 2.5 to 6 per cent nickel can be replaced by 0.25 per cent nitrogen.[22] Thus, new families of stainless steels have grown up in which nitrogen is added as an alloying agent in the form of calcium cyanamide or some other nitrogen-bearing chemical.

Hydrogen—Hydrogen is the villain of the gases. Its solubility in iron at 1-atmosphere pressure is shown in Fig. 11. [15, 32, 34, 37] The sudden drop in solubility on freezing and the much greater solubility in gamma iron than in delta (or alpha) iron are notable features. Fig. 12 demonstrates the effects of certain alloying elements on the solubility in liquid iron.[15] Only a few have yet been studied. None yet has been found which has an important limiting effect on the solubility of hydrogen.

Fig. 13 illustrates the solubility in different solid iron-carbon alloys at different temperatures.[23] Of course, solubility increases with temperature. There is a minimum at about 0.5 per cent carbon and a maximum at 1.5 per cent, but in general one can say that from the lowest carbon steel to the highest carbon cast iron, the solubilities are in the same order of magnitude.

Since the most important source of hydrogen in metals is moisture, Fig. 14 is of interest. [3, 11] It shows the calculated possible absorption of hydrogen in liquid steel from moisture, demonstrates the maximum possible absorption of hydrogen due to various moisture conditions, and also shows that deoxidized metal is more susceptible than undeoxidized metal to hydrogen absorption.

TABLE III—Mechanism of Solution of Other Diatomic Gases in Metals

Gas	Mechanism	Equilibrium Constant	Law (this simplest form often applies)	Temperature Effect in Liquid Iron
XY	$XY(gas) \rightarrow X + Y$ atoms in solution	$k = \frac{a_X \cdot a_Y}{p_{XY}}$	$\%X \cdot \%Y = K\,p_{XY}$	
CO	$CO(g) \rightarrow C + O$	$k = \frac{a_C \cdot a_O}{p_{CO}}$	$\%C \cdot \%O = K\,p_{CO}$	$\log K = \frac{-1860}{T} - 1.643$

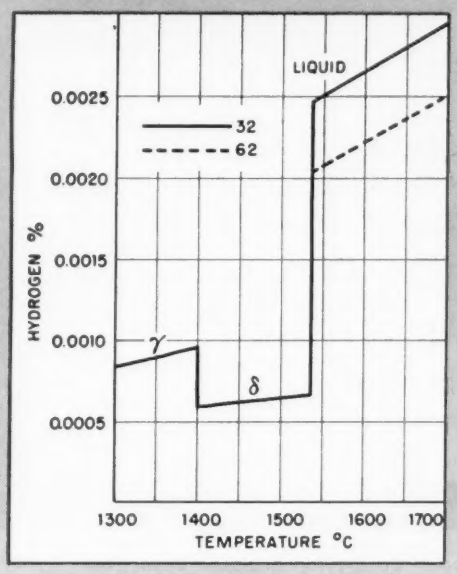


Fig. 11—Showing the solubility of hydrogen in iron at a pressure of one atmosphere[15,32,34,37]

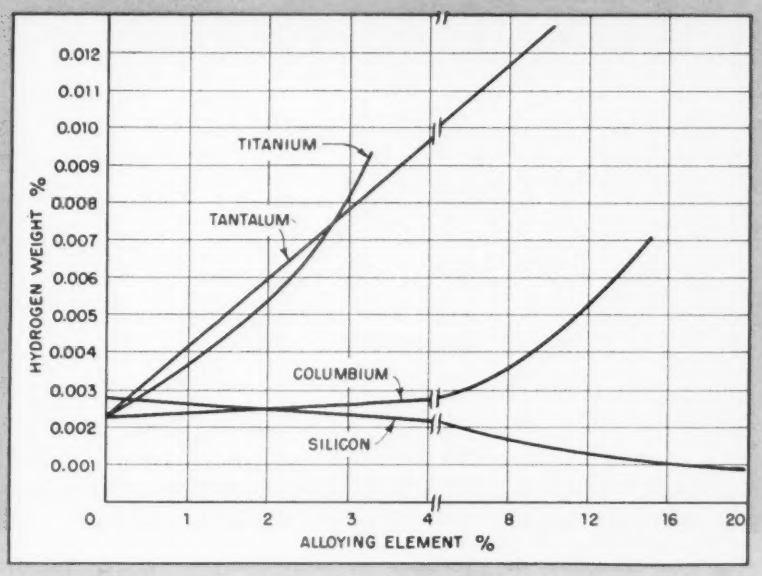


Fig. 12—Hydrogen solubility in binary liquid iron alloys at 1 atmosphere and about 1600°C[15]

Thus hydrogen can get into metals from damp, rusty scrap; water of hydration in limestone, ores, etc.; dampness in alloy additions; water vapor in a furnace atmosphere; humidity in the air, etc. The amount taken up is likely to be greater with alloy irons and steels, which often have higher hydrogen solubilities than pure iron.

Too much hydrogen can cause gassiness on freezing, with porosity in cast products (Fig. 15).[15, 24] Often the chief trouble is caused by the amount still dissolved in sound, solid metal after freezing. This condition holds particularly for rolled or forged steel products. As the metal cools below freezing, the solubility decreases and the hydrogen tries to escape. Nitrogen diffuses comparatively slowly and tends to become tied up as nitrides, but hydrogen diffuses very rapidly. In trying to escape, it apparently can form serious defects which can ruin steel entirely, forming internal cracks or fissures [22, 31] variously called shattercracks, hairline cracks, flakes, etc. (Fig. 16). These shattercracks and flakes seldom occur in low-carbon steel, but are very common in high-carbon and alloy steels unless special treatment is given for hydrogen removal. There are several reasons why low-carbon steel seldom contains shattercracks or flakes. One is that it solidifies as delta iron, which throws any excessive amounts of hydrogen out of solution on freezing. Another is that the long "boil" undergone by low-carbon steel tends to flush out excess hydrogen. Thin sections of high-carbon or alloy steel are not very susceptible to flaking, for the hydrogen has only a short distance to escape to the surface. Thicker sections must be treated specially, or the steel may be worthless. For that reason, every steel rail we ride on and practically every heavy high-alloy steel forging made today is given a special slow-cooling treatment or other special heat treatment to allow the hydrogen to escape. For very heavy forgings, this process may involve a cooling period of as much as two weeks in certain temperature ranges.

The exact mechanism of this crack formation is not completely understood. Some believe that as the hydrogen seeks to escape, it diffuses into tiny holes or discontinuities, forming molecular hydrogen, and builds up great pressures which, although perhaps not high enough to split the steel alone, are aided by tensile stresses resulting from cooling. Wherever the combined effect is greater than the strength, the metal breaks, forming an internal crack.

This type of defect does not appear to be nearly as common in cast steel as in rolled products. One possible reason is that the microscopic and submicroscopic voids in cast products have a much greater total volume than in hot worked metal. Hydrogen pressures in them consequently do not become so high. Another is that most steel castings are cast in sand molds, in which they cool very slowly, allowing much of the hydrogen to diffuse out before the lower, shattercrack-forming temperature ranges are reached. Although many steel foundries may claim they have no shattercrack troubles, the author has observed this defect in medium-carbon, high-carbon and alloy steel castings. It may occur in the middle of heavy sections.

Simple hydrogen embrittlement or impairment of ductility may result when the hydrogen level is high, but the combination of internal stresses from all causes is not great enough for shattercrack or flake formation. This simple embrittlement generally can be cured by enough aging or baking to allow the hydrogen to diffuse to the surface and escape.

Gases in Cast Iron—Considerable volumes of gas are present in liquid cast iron or pig iron. It has been shown that iron ready to cast and held in a ladle gives off gas continuously by a quiet, evaporating (nonbubbling) action.[25] This gas is

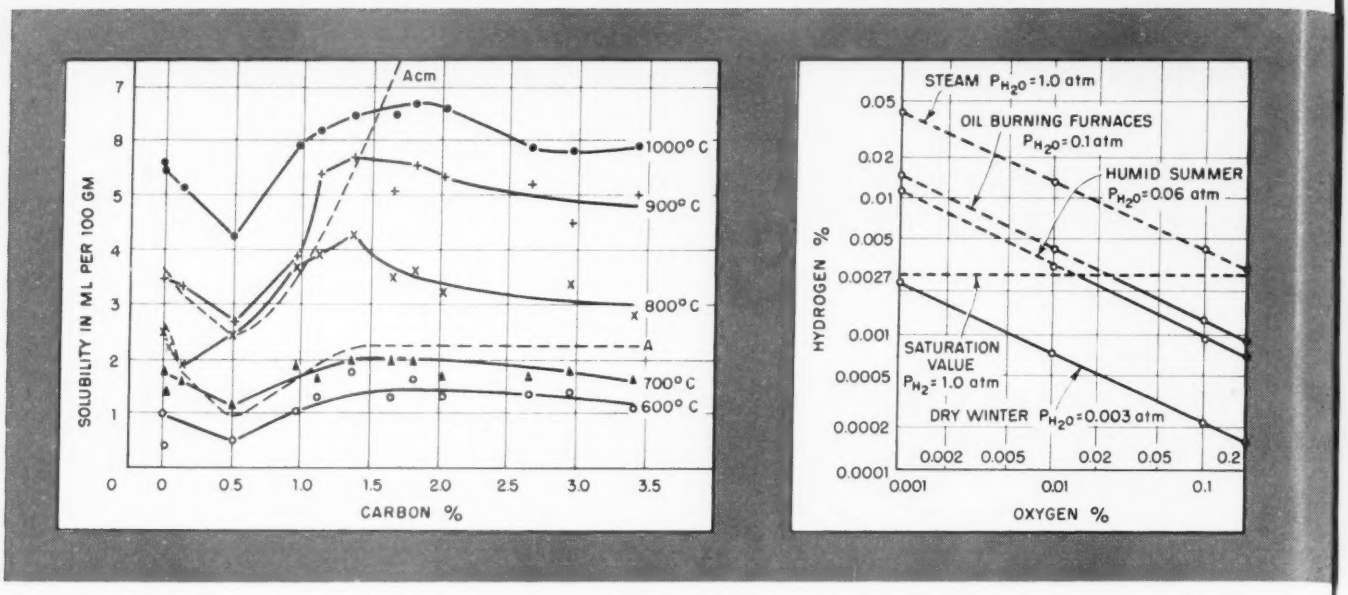


Fig. 13—Solubility of hydrogen in solid iron-carbon alloys at some different temperatures[23]

Fig. 14—Hydrogen absorption in liquid steel from moisture and effect of degree of deoxidation[3,11]

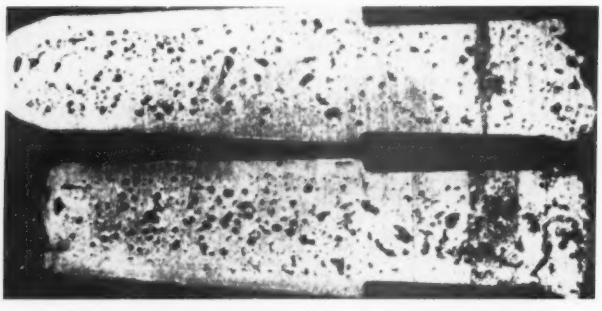


Fig. 15—Cross sections of two ingots of 5 per cent chromium steel show hydrogen porosity[15,24]

likely to be a mixture of N_2, H_2, CH_4 and CO, with nitrogen predominating and hydrogen next in quantity.[25] More gas is likely to be given off during pouring and solidification, and of course this can cause porosity if the bubbles formed during solidification do not escape before the metal around them freezes. The remainder of the gas remains dissolved in the solid metal.

The British Cast Iron Research Association has formed a research team which is working on gases in cast iron.[26] This team already has done some valuable work which is reported in the *Journal of Research and Development* of the association. Members have made a survey of the gases contained in solid cast irons cast from metal produced by common melting processes.[27] Oxygen is likely to vary from 0.0005 to 0.003 per cent in most irons, with cupola melting tending (but not always) to give the highest oxygen. A small induction furnace gave the highest figure of 0.01 per cent — probably because of the good opportunity for contact with air and the stirring action. Nitrogen contents varied from 0.002 to 0.012 per cent, with cupola melting tending to give the highest figures. Hydrogen contents were somewhat uncertain, but low. They vary from 0.00005 to 0.0003 per cent.

The oxygen content of liquid cast iron tends to be very much lower than that of liquid steel because carbon and silicon contents are high. It has been demonstrated by Williams and Lownie[28] that the high oxygen values sometimes reported for gray cast iron are due largely to oxygen picked up by iron after it has been cast. For example, an iron containing only 0.0025 per cent oxygen "as cast" may be found to have 0.011 per cent oxygen 12 months later—having picked up the difference from the air. This oxygen pickup appears to be much less with nodular irons.

The nitrogen contents reported by the B.C.I.R.A. indicate that iron is sometimes nearly saturated with nitrogen when it is cast. This condition can cause porosity on freezing or have other undesirable effects. Dawson, Smith and Bach[29] conclude from their work that nitrogen has a profound influence on the properties and structure of cast iron. Amounts as low as 0.01 per cent have a definite carbide stabilizing effect. Naturally, this property affects the depth of chill in some iron. It also influences the annealing time required in making malleable iron. This effect can be reduced by the addition of small amounts of aluminum.

Charles F. Walton, technical director, Gray Iron Founder's Society, states, "Although hydrogen is an important element in gray iron metallurgy, not enough is known about its effect on our favorite metal."[30] Actually, very little reliable data on hydrogen or other gases in liquid cast or pig iron are available. Although excessive amounts of hydrogen in liquid iron could cause porosity, it is quite possible that nitrogen is responsible for much of the porosity sometimes attributed to hydrogen. Shattercrack problems like those in hot worked steel are not likely to occur in cast iron for the same reason they are not so common in cast steel. Also, graphitic iron contains too large a volume of voids and graphite for the molecular hydrogen to build up great pressures. Indeed, the amounts reported — 0.00005 to 0.0003 per cent — in solid iron[27] seem almost too small to have any appreciable effect. It is quite possible that the carbide stabilizing effects sometimes blamed on

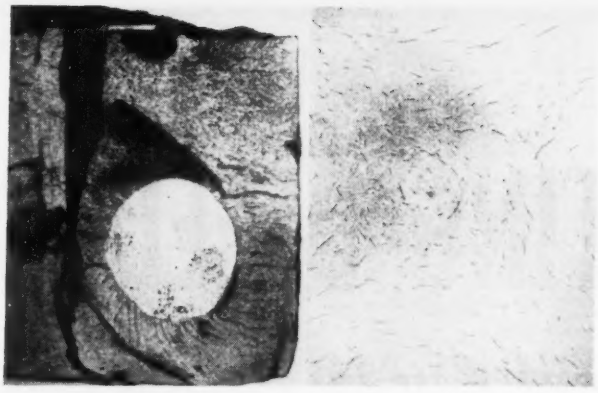


Fig. 16—Flakes or shattercracks in steel. On left is a fracture originating from a shattercrack. Right, macro-etched section of steel[22, 31]

hydrogen are in reality the fault of nitrogen.

Conclusions—It would be impossible for the author to cover the whole of this broad field in a paper of this kind. A review of the voluminous literature leaves one with the impression that a great deal of fundamental research needs to be done before the behavior of the gases will be well understood and before cures for all of the many gas troubles will be found. This statement is particularly true of cast iron. Whereas enough careful fundamental work has been done with steels for us to see part of the picture quite clearly, the reliable data on cast irons are so meager as to make it almost impossible to give definite answers to important questions about gases in cast irons.

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TABLE IV—Mechanism of Solution of Triatomic Gases in Metals

Gas	Mechanism	Equilibrium Constant	Law (this simplest form often applies) $\%X \cdot \%Y^2 = K p_{XY_2}$	Temperature Effect in Liquid Iron
XY_2	$XY_2(gas) \rightarrow X + 2Y$ atoms in solution	$k = \frac{a_X \cdot a_X^2}{p_{XY}}$		
SO_2	$SO_2(g) \rightarrow S + 2O$	$k = \frac{a_S \cdot a_O^2}{p_{SO_2}}$	$\%S \cdot \%O = K p_{SO_2}$	$\log K = \frac{293}{T} + 2.8$
H_2O	$H_2O(g) \rightarrow 2H + S$	$k = \frac{a_{H^2} \cdot a_O}{p_{H_2O}}$	$\%H^2 \cdot \%O = K p_{H_2O}$	$\log K = \frac{-10,400}{T} - 0.19$
H_2S	$H_2S(g) \rightarrow 2H + S$	$k = \frac{a_{H^2} \cdot a_S}{p_{H_2S}}$	$\%H^2 \cdot \%S = K p_{H_2S}$	$\log K = \frac{-11.9}{T} - 1.93$
CO_2	Exception $CO_2(g) \rightarrow CO(g) + O$	$k = \frac{p_{CO} \cdot a_O}{p_{CO_2}}$	$\%O = \frac{K p_{CO_2}}{p_{CO}}$	$\log K = \frac{-8316}{T} + 4.53$

BRASS CASTING DEFECTS

. . . Their Causes and Cures

LAST month, in the first part of this discussion of brass casting defects, ten types of flaws, their causes and their remedies were discussed. The following analysis of ten additional defects completes this discussion.

11. Surface Imperfections—This term covers a multitude of sins, some of which already have been described. At this point we have in mind any foreign substance carried with the stream of metal and deposited in the surface of the casting.

a. A pitted appearance may be the result of embedded sand which was removed when the casting was blasted. The sand from a sand wash, already mentioned, will be deposited somewhere on the metal surface. Or the sand inclusions may be the result of a dirty mold which the molder neglected to blow out with his air hose. A crush, too slight to be noticed as such, also may cause dirty castings.

b. Foreign materials such as bits of charcoal, slag and metal oxides, which may be either solid or liquid, lodge in the castings if the metal was skimmed inadequately before or during pouring. Prevention of this problem was discussed in a previous article on pouring practice. Chokes of various kinds, such as strainer cores or choke gates, help to locate floating foreign materials in the sprue and runner, rather than in the castings.

c. Worm tracks and smoke holes are descriptive terms for a surface defect which appears as elongated, irregular depressions or sometimes as holes completely through the wall of a casting. Before blasting, these depressions are filled with a white powder, presumably zinc oxide. Apparently this trouble occurs only when the metal fumes so excessively that the atmosphere in a partially full runner or mold cavity contains much zinc oxide which cannot escape and so lodges in the casting.

The cause of the excessive fuming is somewhat of a mystery. At times an alloy such as 85-5-5-5 will fume badly, but at other times, with all conditions apparently the same, there is no trouble. Too much phosphorus has been suggested as the source of trouble, but experience indicates that although phosphorus may be a contributing factor, it is not the basic cause. Red brasses badly contaminated with silicon always show worm tracks, but this contamination is not an exclusive cause.

At the first appearance of the difficulty it is necessary, for the time being, to abandon the use of strainer cores and other choking devices in order to fill the mold as rapidly as possible.

d. Superficial black stains on the surface of red brass or bronze castings most likely are due to an excess of iron and phosphorus in combination.

e. Heavily leaded semi-red brasses at times are afflicted with considerable amounts of free lead on the surface of the casting. As the metal solidifies, a segregation of still molten lead is forced to the surface of the casting by its volume shrinkage. If considerable amounts of gas are set free at the same time, the trouble is aggravated. Lead segregation can be controlled by maintaining the proportions of tin and zinc at proper levels. For example, an alloy containing 10 per cent lead should have at least 3 per cent tin and 6 per cent zinc.

f. Lumps, sometimes due to pellets of metal in the molding sand, not only spoil the appearance of the casting, but also may interfere with proper chucking in the machine shop.

12. Burning into Sand—This defect is characterized by an exceedingly rough casting surface with sand grains trapped in the metal. The trouble can be due to sand which is too weak or too coarse, but more often is caused by excessively fluid metal. It will occur if the metal is poured too hot or contains too much phosphorus.

13. Burning into Cores—The same conditions responsible for sand burn-in also cause burning into cores. Silicon or aluminum contamination contributes to this condition. A more common core ailment occurs when the core cracks as a result of contact with hot metal. Molten metal enters the crack, forming a fin. Possibly the core contains excess binder or has been overbaked. If a very smooth cored surface is desired, a core wash helps.

The molder should blow molds clean with his air hose, or sand inclusions may spoil his castings

Last month Mr. St. John began a discussion of brass casting defects which is concluded by this article. It is No. 13 in his series, *The Brass Foundry*

By HARRY ST. JOHN
Foundry Consultant

14. Core Blocks—Cored passages sometimes are blocked by portions of core which may be inaccessible or difficult to remove. If a sufficiently soft core mix cannot be used, it may be necessary to go to the expense of employing a wash with a rubber or synthetic resin base. If there are two passages with a common outlet and only one is blocked, it is difficult to discover the defect. One method is to plug the outlet and measure the volume of water the cavity will contain. If a perfect casting will hold 95 cc and another is found to contain only 80 cc, there evidently must be a block in the latter.

15. Cleaning Room Spoilage—If a casting is marred or partly cut away when it is removed from the gate in the cleaning room, the cause of the defect and its remedy are obvious. Of course there always is the possibility that a gating change will make the fault less likely to occur. Rough handling sometimes is responsible for scrap. Other spoilage possibilities are as follows:

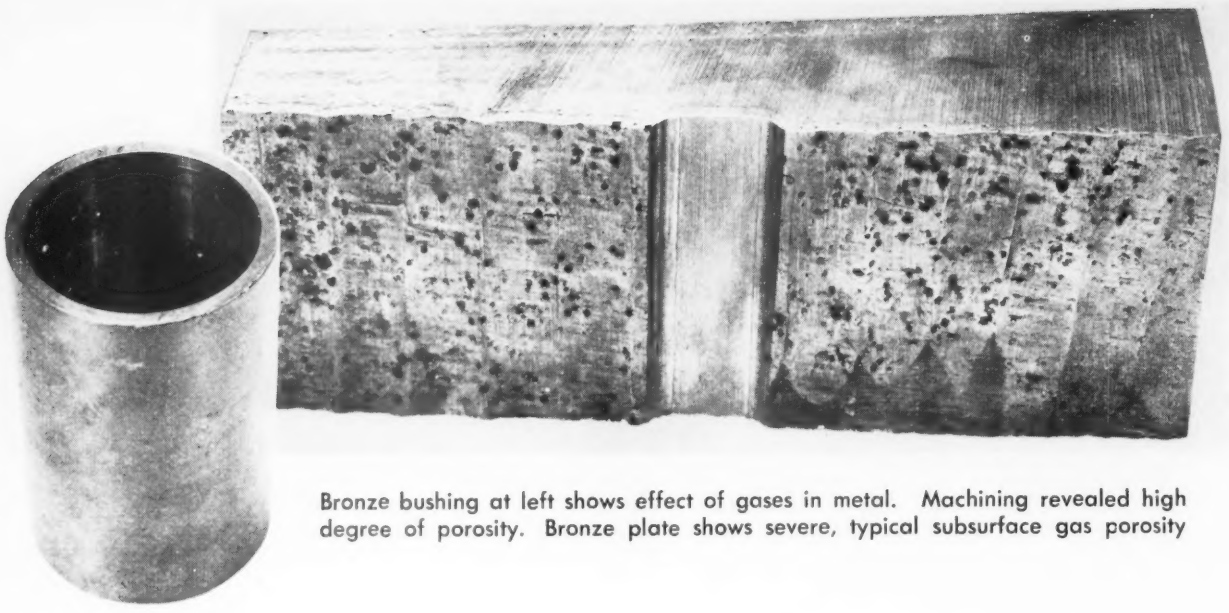
a. If a gate pulls out of the casting, taking part of the casting with it, the trouble may be due to a dull knife in the punch press cutoff, or it may point to the fact that a heavy gate cannot safely be attached to a thin casting wall.

b. If steel blasting is employed and the steel grit is not kept clean of fines, tiny particles of steel may be driven into the wall of the casting. These rust, and it is impossible to make the casting presentable.

This group concludes the list of defects which can be detected before castings are machined. Those which follow appear only when part of the casting has been cut away. These hidden defects are particularly annoying because much work has been done on the casting before they are found. Most painful of all is to have a fully machined, apparently perfect casting leak when given a pressure test or to be rejected after polishing and plating.

16. Core Blow—Smooth-walled cavities, usually of considerable size, directly beneath the skin of the casting, can be attributed to core gas. If the walls of the cavity are black and shiny, the difficulty unquestionably is a core blow; if they are gold colored, the cavity may be due to core gas or to gas from solution in the metal. A heavy section almost completely surrounded by sand is particularly susceptible to this kind of trouble.

An imperfectly baked core may be responsible, or the design of the casting may be such that a core containing the least possible amount of organic binder is needed. Venting the core often helps, and sometimes these vents should be continued to the outer surface of the mold. If a core wash or core paste is used, it should be thoroughly dried in a



Bronze bushing at left shows effect of gases in metal. Machining revealed high degree of porosity. Bronze plate shows severe, typical subsurface gas porosity

steam oven or, alternatively, with infrared lamps.

17. Spatter Cavities—This term describes a condition in which drops of metal find their way into the mold and freeze before the main stream of metal arrives. These drops do not coalesce, but lodge in the wall of the casting. They are torn out when the machine tool strikes them or, if deep-seated, are likely to cause a leak. The trouble may be due to gating or to careless pouring.

18. Shrinkage Cavities—These are of various kinds and have more than one cause. All have in common, however, a failure to feed some section of the casting until solidification is complete. In alloys with a short freezing range, such as those high in zinc, shrinkage is apt to show up as hollows in the outer surface of the castings. These can be seen and the castings discarded before machining. In the red metals, where over-all shrinkage is less, but freezing is slow, shrinkage takes the form of internal cavities or voids between crystals.

a. In a well-designed, properly gated casting, shrinks are due to sluggish metal or too low a pouring temperature.

b. In a casting so designed or gated that a heavy section is fed through a light section, the flow of metal is cut off before solidification of the heavy section is complete, and a cavity results. If this cannot be corrected by regating, the use of a chill may be the only answer. Where only one or two castings are in the mold, risers may serve the purpose.

c. In a poorly designed casting there may be a relatively heavy section which cannot be reached for feeding, or heavy and light sections may adjoin sharply with no fillet to ease the transition. Such a casting cannot be made successfully until these faults have been corrected.

d. Dispersed shrinkage areas, marked by a coarse, discolored fracture in heavy sections, may be due to pouring too hot. Even though an ample feed apparently is provided, crystals may grow to such size as to block partially the flow of metal needed to fill the space between them. Then, as these crystals shrink on cooling, they pull apart, leaving considerable voids. An evolution of gas during crystal growth will interfere still further with feeding. A lower pouring temperature sometimes solves the difficulty, or it may be necessary to bring another gate into the affected area. When permissible, the addition of nickel also helps, since it tends to multiply the number of crystals and to reduce their size.

19. Weak, Open Structure — Large dendritic crystals, ranging in color from bright gold to orange, brown and black, result in a casting which is weak and not pressure-tight.

a. This condition may be due to hot pouring, as described above.

b. It may be caused by the presence of aluminum or silicon.

c. In red brass or bronze castings, very heavy sections almost invariably show an open structure near the center of the section. Such a casting leaks slowly under heavy pressure if the dense outer skin is machined away. The addition of 2 per cent nickel helps materially to overcome the difficulty. Another practice, with which the writer has had some success in the case of gun metal, is to superheat the metal to some 400° F above the desired pouring temperature and then allow it to cool slowly before pouring.

20. Hard Spots—Sometimes sufficient to cause tool breakage, hard spots may be due to free iron. The source of this trouble and its correction were discussed in the article on impurities. Drops of oxide slag form in overoxidized metal as it cools, and they are likely to come to rest in the castings. Inadequate skimming of the metal already has been mentioned as a source of surface defects. It also may result in defects which come to light only during machining.

21. Failure to Clean Up—This defect is an apparent lack of metal to provide machine finish on a surface where finish is called for. The tendency to blame the foundry for this condition sometimes is unfair. To be sure, it may be due to an off-center cored hole or to some other foundry dimensional discrepancy, but it also may be due to a

faulty chuck or an error in setting tools. In his own defense the foundryman needs to know something about the machining operations his castings will undergo.

22. Gas Porosity—It sometimes is argued that finely dispersed gas throughout the body of a casting is useful in overcoming shrinkage cavities and does no great harm. This may be true in badly designed castings in which a shrink is difficult to avoid, provided maximum metal strength is not required. On the other hand, such metal is weak and will not pass many requirements. In any case, visible gas holes in a machined surface constitute a defect which the foundryman must seek to avoid. The evidence of gas porosity ranges from the microporosity mentioned above through small but clearly visible bubbles to large bubbles which, in extreme cases, may resemble a honeycomb. They most commonly are found in the cope or trapped beneath a core in the drag. Sometimes a stream of tiny bubbles emanates from a fragment of foreign substance embedded in the metal.

a. Microporosity often is found in metal melted under a reducing atmosphere in fuel-fired furnaces. A slightly oxidizing atmosphere is essential to avoid it.

b. The presence of water vapor in any melting operation, notably in new or heavily patched electric-furnace linings, results in either microporosity or visible gas.

c. Incompletely dried ladles will cause gas porosity.

d. High atmospheric humidity, frequently experienced during the summer, can be responsible for an unusual number of gas porosity rejects. Perhaps some day our foundries will be air-conditioned!

Gassed condition of metal can cause other problems than porosity. In leaded-tin-bronze casting shown, it resulted in inverse segregation

Fissuring or whiskering in 80-10-10 bushing is probably the result of soft ramming of the core

e. The solubility of gas in the brasses and bronzes increases with the degree of superheat. Metal poured into molds at too high a temperature almost invariably shows porosity due to gas which has not been given time to escape from solution.

f. There is evidence that carbon is slightly soluble in the red alloys. If so, it is almost certain to react with metallic oxides to form carbon-monoxide gas within the casting during solidification.

g. It is generally believed that excessively wet molding sand will cause gassy castings. This sounds plausible and may be true. However, the writer once witnessed an unsuccessful attempt to prove this point. Castings were poured in sand which was little better than mud. Although badly blown on their outer surfaces, they had perfect fractures, with no evidence of gas porosity. Apparently the metal chilled so quickly that steam had no chance to penetrate the casting walls. Molds less wet, but still containing excessive moisture, also yielded no gassy castings.

h. Very large gas holes widely distributed throughout the cope most likely are due to mold gases in a mold with low permeability, with possibly an excess of core gas. One common cause of trouble often is overlooked. Cores left in an unpoured mold overnight will absorb water, and, since the core has no great chilling effect of its own, this moisture is likely to enter the metal. Cores left in storage for a long time also may pick up moisture. In a production foundry it is convenient to leave unpoured molds overnight, but the results should be watched carefully.

If scrap rejections are to be held at a low level, the causes of the scrap and effective remedies for them must be known. For over-all foundry economy it further is necessary to know quantitatively to what extent each defect is responsible for losses. A statistical approach to this problem will be described in the next article.

Mechanical Properties of a Normalized and Drawn

CAST BORON STEEL

This paper reports on mechanical properties of a low-carbon boron steel which has high tensile properties in both light and heavy sections after normalizing. In addition, it is readily weldable

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THE steel industry can turn to boron as a substitute element in times of alloy scarcity, but boron steel demands strict metallurgical control of production and heat treatment. Consequently, when alloys are in pentiful supply, conventional steels usually are preferred. Research into the metallurgy of boron steels is continuing, however, to encourage wider acceptance by the steel industry.

A wrought low-carbon boron steel recently was developed in the United Kingdom. It has good tensile properties after normalizing.[1,2,3]

The composition range of this steel is 0.11-0.15 per cent carbon, 0.40-0.60 per cent molybdenum and 0.002-0.004 per cent boron. Prior to this development, boron was effective in steels only after liquid quenching.

This steel possesses two characteristics which could be exploited for certain castings. First, it readily is weldable by virtue of low carbon and low alloy content. Second, high tensile properties are developed in both light and heavy sections. Comparable high tensile properties usually are obtained in castings by normalizing and drawing higher-carbon alloy steels or by liquid quenching and drawing plain or low-alloy medium-carbon steels. These steels are more difficult to weld and do not maintain their higher strength in heavy sections. Furthermore, liquid quenched steels are susceptible to cracking, especially if the design is intricate.

This paper reports the mechanical properties of the normalized and drawn boron steel. Variables studied included effect of section size, effect of temperature on impact strength and effect of rare earth additions.

Melting Practice—Ten 550-lb heats were produced for this investigation in a three-phase, basic, direct-arc furnace. Each heat was split either in halves (one half for boron only and the other for either boron plus rare earth or as a blank) or in thirds (one third as a blank, one third for boron only and one third for boron plus rare earth). Two preheated shank ladles were used to pour each heat.

Heats were deoxidized in the ladle with 2 lb of aluminum per ton and 4 lb of calcium-manganese-silicon per ton. Part of the aluminum addition was placed in the bottom of the ladle, and the calcium-manganese-silicon was added gradually to the metal stream after the ladle was about one-third full. Rare earths were added as a single lump when the ladle was about one-quarter full.

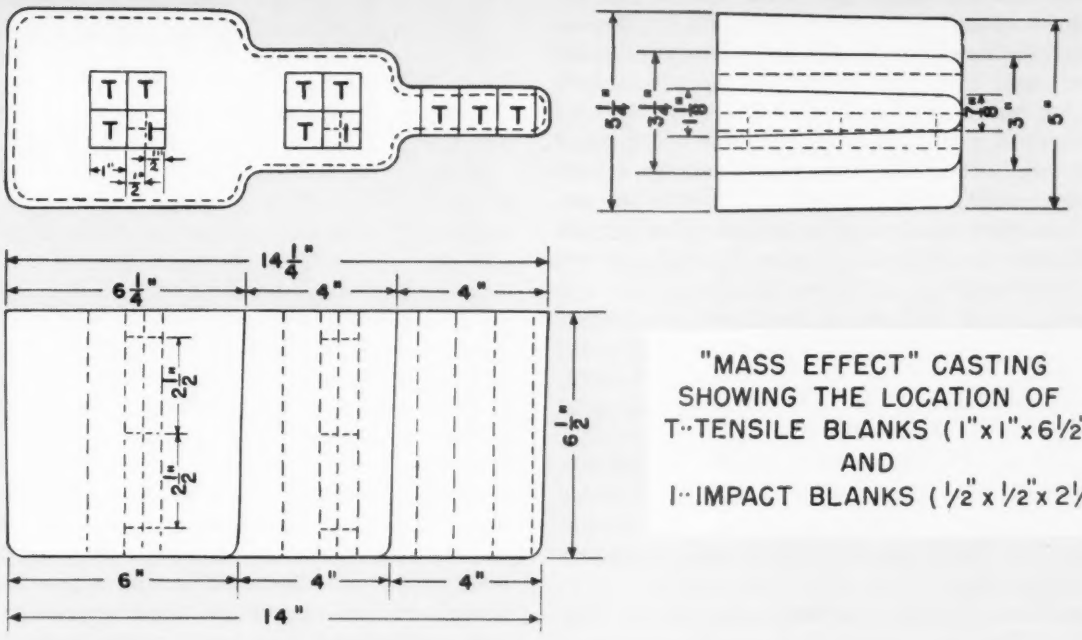
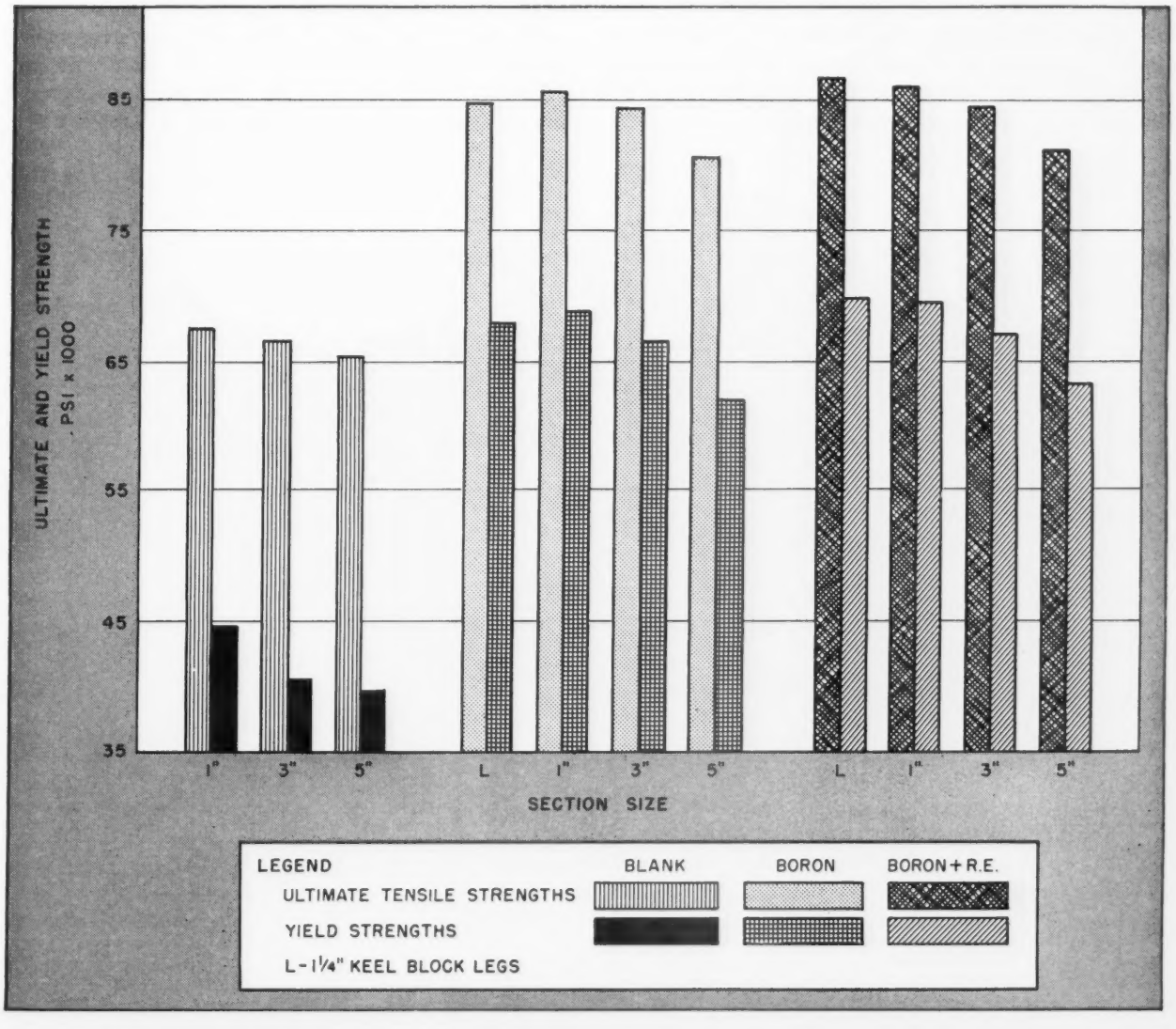


Fig. 1—Mass effect castings were poured into green sand molds, weighed 85 lb, had 1, 3 and 5-in. sections and were fed by 6 x 9-in. riser

Fig. 2—Bar graph shows mean ultimate and yield strengths for "blank" heats (no boron or rare earths) and boron and boron plus rare earth heats



The rare earth addition had the following composition: Cerium, 45-50 per cent; lanthanum, 30 per cent (minimum); and elements 59 to 71 plus yttrium, 20-24 per cent. Rare earth elements totaled 99 per cent. Iron plus unreduced salts was held to a 1 per cent maximum.

Ferroboron additions were placed in a cup made of 1.4 oz of sheet aluminum (the balance of the aluminum addition) which was attached to one end of a $\frac{5}{8}$-in. diam steel rod. The cup was plunged and stirred into the ladle after slag removal. Ferroboron additions were 11.54 per cent boron.

Castings and Test Bars—Standard keel blocks which weighed 55 lb and had four legs 1¼ x 1¼ x 6½-in. were bottom-gated into green sand molds. Each leg provided either one tensile bar or eight impact bars.

Mass effect 85-lb castings with 1, 3 and 5-in. sections were poured into green sand molds. Feeding was by a 6 x 9-in. riser on the 5-in. section. This casting and locations of the tensile and impact blanks are shown in Fig. 1.

Mass Effect Casting—All tensile bars were 0.505-in. diam. They were pulled on a tensile machine of 60,000-lb capacity.

All Charpy V-notch bars were checked by micrometer and on an optical comparator. An impact tester of 120-ft-lb capacity and a striking velocity of 11 fps was used to measure impact strength. The impact tester had been inspected and tested on the basis of data supplied by the manufacturer in accordance with ASTM procedures. In addition impact test specimens were checked by another laboratory with a testing machine approved by Watertown Arsenals. To handle the impact specimens, special tongs were used which insured proper alignment in the supports. These tongs were cooled with the specimens when testing was carried out at subzero temperatures.

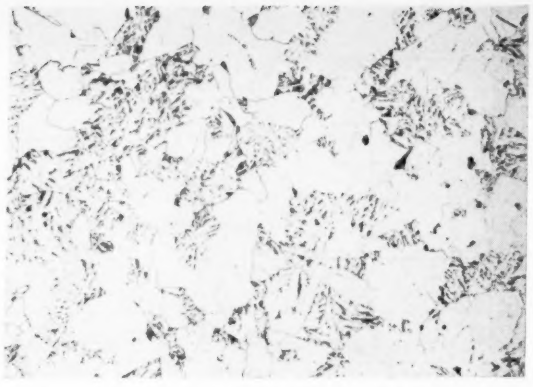


Fig. 3—Microstructure of 5-in. section of heat F, with boron and rare earths. X100, 2% nital etch. Yield strength 46,600 psi, brinell 144

Heat Treatment—Keel block legs were normalized after holding for 2 hr at 1650 to 1700°F. They then were drawn for 2 hr at 1100°F and air cooled.

Whole mass effect castings were held for three hours at these austenitizing and tempering temperatures.

Composition—Table I lists the analyses of the heats produced. Both chemical and quantitative

TABLE I—Composition of Experimental Heats

Heat	C, %	Mn, %	Si, %	S, %****	P, %	Mo, %	Al, %**	N_2, %	B, %**	Rare Earth, %*	Castings Poured
A***	0.16	0.72	0.45	0.015	0.017	0.63	0.11	0.015	1st half 0.0029	0	2 Keel blocks
									2nd half 0	0	2 Keel blocks
B***	0.16	0.90	0.30	0.025	0.021	0.53	0.10	0.010	1st half 0	0	2 Keel blocks
									2nd half 0.0018	0	2 Keel blocks
C***	0.18	0.91	0.47	0.020	0.014	0.54	0.11	0.013	1st half 0	0	2 Keel blocks
									2nd half 0.0023	0	2 Keel blocks
D	0.12	0.60	0.38	0.028	0.015	0.50	0.089	0.008	1st third 0	0	1 Mass effect
									2nd third 0.0024	0	1 Mass effect
									last third 0.0024	0.15	1 Mass effect
E	0.12	0.80	0.34	0.021	0.016	0.49	0.068	0.008	1st half 0.0028	0	2 Keel blocks & 1 Mass effect
									2nd half 0.0033	0.15	2 Keel blocks & 1 Mass effect
F	0.11	0.65	0.27	0.022	0.018	0.50	0.067	0.008	1st half 0.0028	0.15	2 Keel blocks & 1 Mass effect
									2nd half 0.0028	0	2 Keel blocks & 1 Mass effect
G	0.11	0.61	0.31	0.027	0.029	0.53	0.055	0.002	1st half 0.0028	0	2 Keel blocks & 1 Mass effect
									2nd half 0.0023	0.15	2 Keel blocks & 1 Mass effect
H	0.11	0.68	0.28	0.018	0.022	0.60	0.068	0.010	1st third 0	0	1 Mass effect
									2nd third 0.0028	0	1 Mass effect
									Last third 0.0030	0.15	1 Mass effect
I	0.11	0.67	0.37	0.017	0.038	0.51	0.078	0.009	1st third 0	0	1 Mass effect
									2nd third 0.0023	0.15	1 Mass effect
									Last third 0.0022	0	1 Mass effect
J	0.10	0.75	0.33	0.017	0.024	0.54	0.09	0.004	1st half 0.003	0	2 Keel blocks
									2nd half 0.003	0.15	2 Keel blocks

* Percentages of rare earth are the amount added — no analysis was made
** Boron and aluminum determined by quantitative spectrographic analysis
*** Carbon content was varied to determine minimum and maximum tensile and impact properties
**** Rare earth additions, in the amounts added, did not lower sulphur content

spectrographic analyses are reported. No significant amounts of residual elements were detected by semi-quantitative spectrographic analyses.

Tensile Tests—All tensile test results are tabulated in Table II. The results for heats A, B, C and D are the average of three tests. The remainder are averages of two tests except for the one noted in the table.

Fig. 2 is a bar graph showing the mean ultimate tensile and yield strengths for different section sizes of the six low-carbon heats.

Table II and Fig. 2 each show the relatively large increase in the ultimate tensile strength and yield strength resulting from the addition of about 0.003 per cent boron. This high strength depends on the development of a characteristic microstructure, shown in Fig. 8. When this structure was present, only one case occurred where the yield point was not eliminated.

At the lower carbon level (heats D to I inclusive), the yield strength to ultimate tensile strength ratio is about 0.80 in the normalized and drawn condition for the smaller sections. This ratio is similar to that developed in conventional steels[4] by quenching and tempering to the same tensile level. The ratio drops to 0.75 at the upper carbon level (heats A, B and C).

Fig. 2 also illustrates the moderate decrease in tensile strength with increase in section size. The decrease averages approximately 1500 psi from the 1 to 3-in. sections and 3500 psi from the 3 to 5-in. sections.

Table II includes two low yield strengths for 5-in. sections—namely, heats D and F. The microstructure (see Fig. 3) contained excess free ferrite, possibly because of either the amount of effective boron in the steel or a retarded cooling rate.

Table III shows the effect of two draw temperatures (1000 and 1200°F) on the tensile properties of the three high-carbon heats (A, B and C). Neither half of heat B was affected appreciably, but the halves of heats A and C with boron showed decreases in tensile strength and increases in tensile ductility at the higher draw temperature. Without boron, these heats showed a decrease in ultimate tensile strength and a slight increase in yield strength at the higher draw temperature, with little difference in ductility. Of all the heats studied in this investigation, only heat C, drawn at 1200°F, showed a yield point when boron was present.

Impact Strength—The mean impact strengths of the six low-carbon heats, tested at room temperature and at −40°F, are shown graphically in Fig. 4. This graph illustrates the effect of additions of boron and boron plus rare earth and the apparent effect of section size. Statistical treatment showed, however, that section size had no significant effect on the impact properties.

Scatter of Results—Fig. 5 is a plot of the individual results for the different conditions investigated, disregarding section size. The highly scattered results are quite notable in this figure, particularly when boron is present. The averages, shown in the graph by vertical lines, indicate that rare earth additions improve the impact strength of this cast boron steel.

Fig. 4—Bar graph shows mean impact strengths of six low-carbon heats, blank and with boron and boron and rare earths, at room temperature and at −40°F

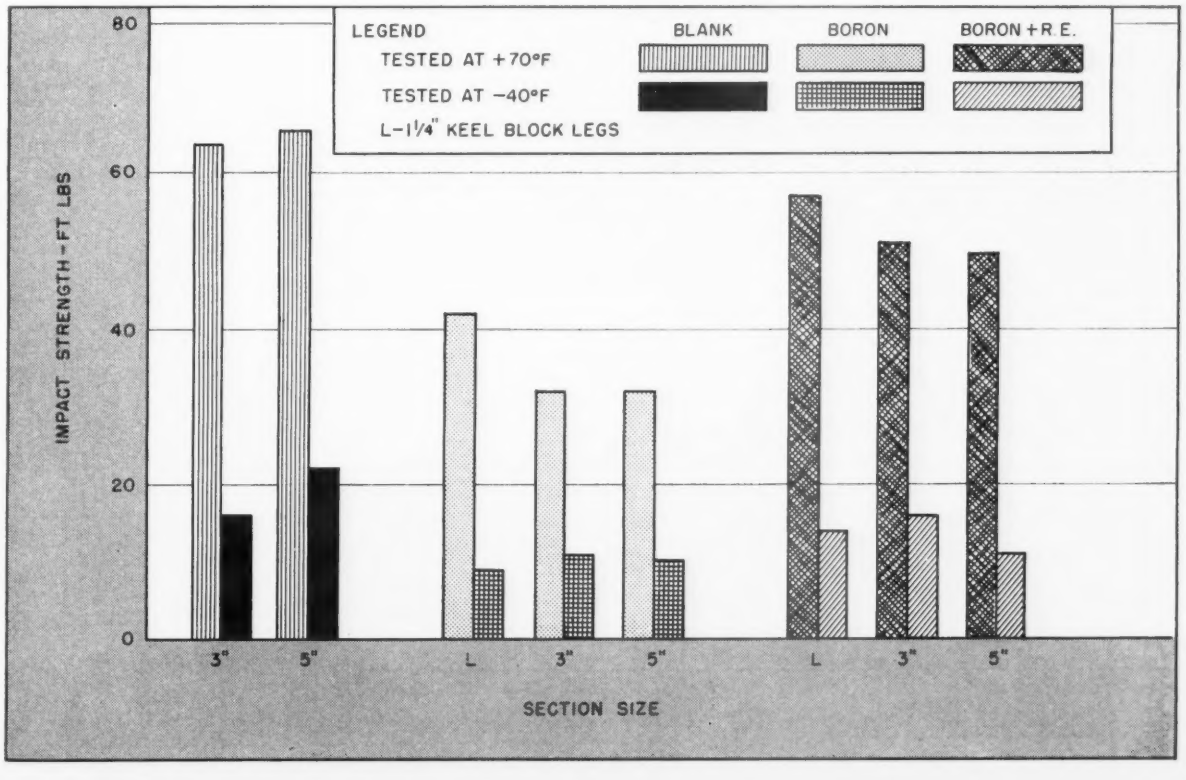


TABLE II—Tensile Properties of Steels Investigated, Showing Effects of Boron and

Heat	Section Size, Inches	Ultimate Tensile Strength, psi			Yield Strength, psi** (0.2% Offset)			Yield Strength / U. T. S. x 100			Elongation in 2", %		
		Blank	Boron	B+R.E.	Blank	Boron	B+R.E.	Blank	Boron	B+R.E.	Blank	Boron	B+R.E.
A	1¼" legs	74,600	89,500		48,500	66,300		65	74		30	21	
B	1¼" legs	75,600	94,300		45,600	69,200		62	73		29	20	
C	1¼" legs	78,600	93,400		56,500	72,900		72	78		29	21	
D	1" Section	67,600	84,030	84,900	43,700	66,300	68,700	65	79	81	34	24	24
	3" Section	66,030	80,350	83,900	38,900	61,000	65,750	59	76	78	33	23	23
	5" Section	64,500	72,400	79,800	37,700	50,050	61,500	58	63	77	33	25	24
E	1¼" legs		84,700	92,500		67,600	73,600		80	82		24	23
	1" Section		85,600	89,600		68,250	72,300		80	81		23	24
	3" Section		84,550	89,200		66,000	71,000		78	80		23	22
	5" Section		81,600	87,000		63,200	69,200		77	80		23	23
F	1¼" legs		81,600	81,950		65,000	65,100		80	80		24	23
	1" Section		82,800	80,600		65,700	62,700		79	78		24	23
	3" Section		80,550	76,650		62,550	57,500		78	75		23	25
	5" Section		77,500	69,000		58,400	46,900		75	68		24	26
G	1¼" legs		88,000	87,500		71,000	70,850		81	81		23	23
	1" Section		87,150	86,050		69,450	70,100		80	81		22	22
	3" Section		87,200	85,050		69,900	68,700		80	81		22	23
	5" Section		84,600	81,250		66,800	63,500		79	78		21	23
H	1" Section	68,500	89,250	87,100	46,550	73,350	72,150	68	82	83	32	23	23
	3" Section	66,750	88,200	86,000	41,350	71,200	70,350	62	81	82	33	23	23
	5" Section	65,900	85,900	85,500	40,950	69,400	70,500	63	81	82	31	20	23
I	1" Section	67,400	86,150	88,250	43,900	69,650	72,150	65	81	82	33	21	25
	3" Section	66,800	84,700	87,250	41,500	67,750	69,600	62	80	80	36	24	23
	5" Section	65,450	82,300	84,300*	40,550	64,300	67,300*	62	78	80	33	22	21*
Avge. (D to I)	1¼" legs		84,800	86,570		67,870	69,850		80	81		24	23
	1" Section	67,800	85,830	86,060	44,720	68,780	69,680	66	80	81	33	23	23
	3" Section	66,530	84,260	84,670	40,580	66,400	67,150	61	79	79	34	23	23
	5" Section	65,280	80,720	81,140	39,730	62,020	63,150	61	75	77	32	23	23

* Single test only
**All yield strengths for Blank were determined by drop in beam methods.

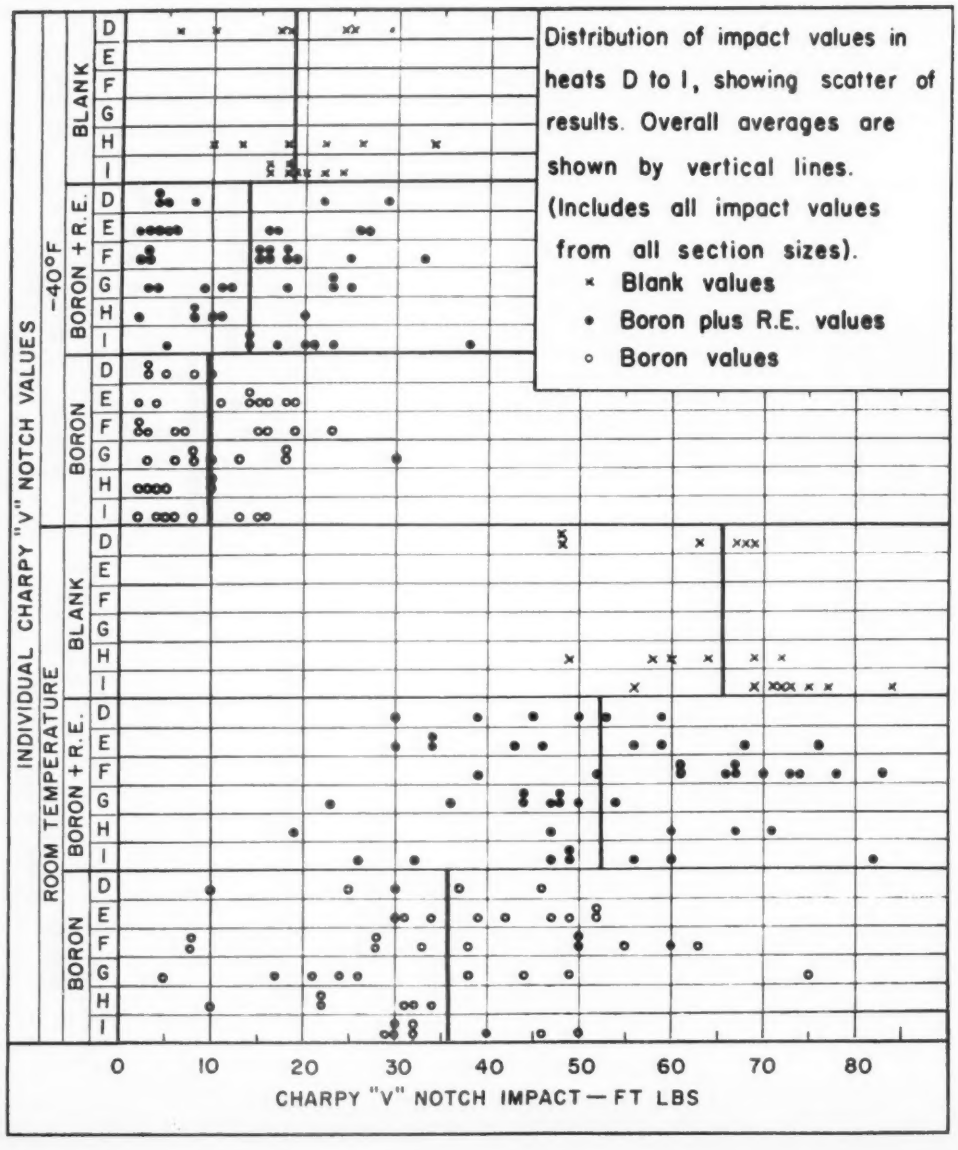


Fig. 5—Graph shows the distribution of impact values in the six low-carbon heats. It plots individual results for the various conditions investigated, with no regard to section size

of Boron Plus Rare Earths

Reduction in Area, %			Brinell Hardness		
Blank	Boron	B+R.E.	Blank	Boron	B+R.E.
59	52				
57	56				
58	46				
64	56	65	136	180	182
62	54	61	125	172	180
61	54	63	124	171	172
	63	64		183	191
	58	59		184	191
	57	60		181	187
	59	56		176	180
	65	65		178	174
	62	64		156	155
	61	61		173	161
	58	61		168	147
	64	63		191	186
	59	61		185	182
	57	61		179	179
	54	60		177	162
62	58	59	130	188	189
62	59	61	128	187	186
59	51	62	125	186	181
63	56	64	131	179	186
65	60	55	126	179	185
59	58	50*	126	178	183
	64	64		187	184
63	58	62	132	180	179
63	58	60	126	179	179
60	57	59	125	177	170

This improvement amounted to about 40 per cent at both room temperature and −40°F, the average increases being 16 and 4 ft-lb respectively. Statistical analysis showed that these differences were too great to have occurred by chance alone and, therefore, the rare earth addition produces a real increase in impact strength. It can be seen, however, that additions of boron and boron plus rare earth lowered the average impact strength.

A more complex boron additive was tried[5] in one heat (not listed). It had the following analysis: Titanium, 15.78 per cent; silicon, 2.65 per cent; carbon, 5.88 per cent; and boron, 1.74 per cent. The titanium present in this alloy would tend to tie up some of the nitrogen in the steel. Results showed that the additive had no effect on either impact strength or the scatter of impact results.

It also has been stated[5] that the sulphur plus phosphorus percentage may affect the impact strength, but no such correlation could be established for the results reported here.

Impact Transition Range—Fig. 6 is a graph showing the impact transition range for heat J, half of which was treated with ferroboron and the remainder with ferroboron plus rare earth. The transition from 100-per-cent-ductile to 100-

Fig. 6—Graph shows impact transition range for heat J, half of which was treated with ferroboron and the remainder with ferroboron plus rare earths

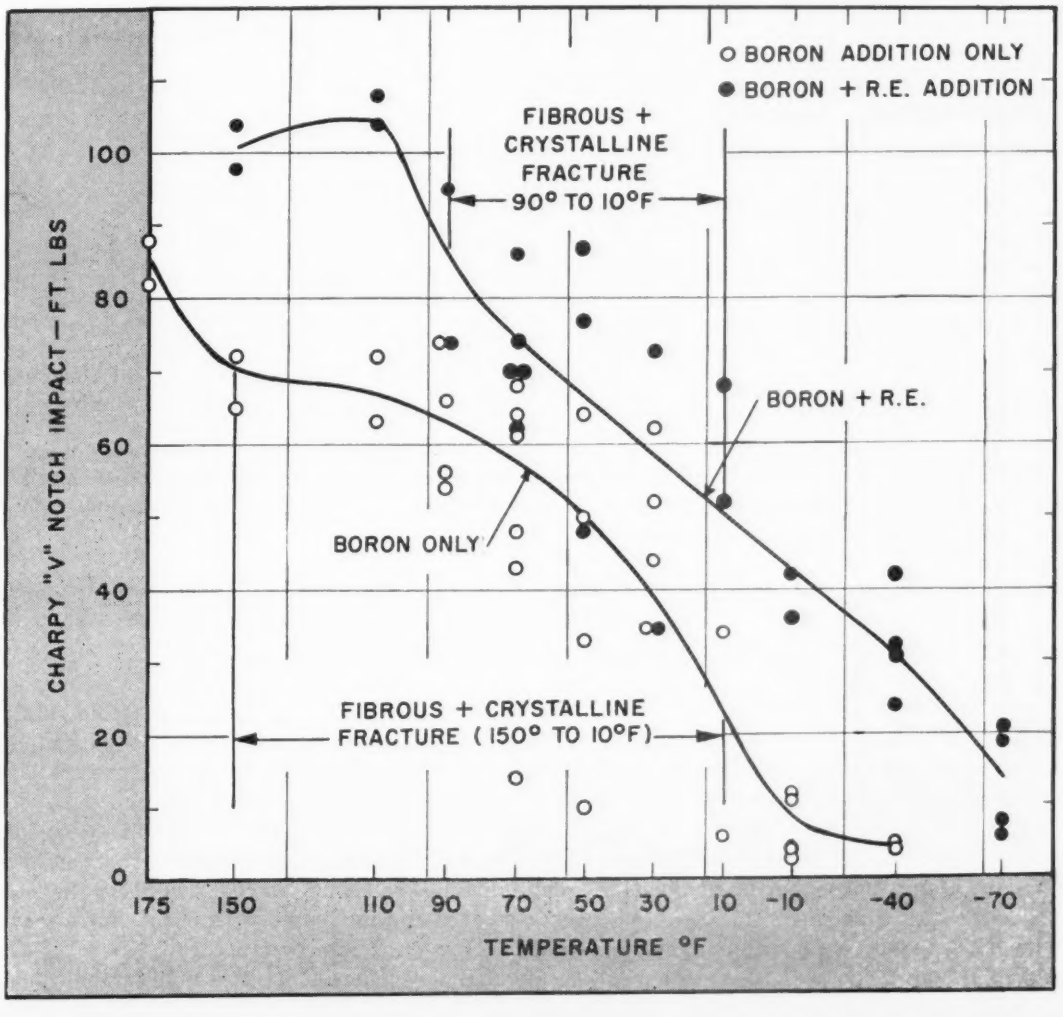


TABLE III—Effect of Draw Temperature on the Tensile Strength of Heats A, B and C*

Heat	Boron Addition	U.T.S., psi, x 1000		Yield Strength, psi, x 1000		Yield Strength / U.T.S. x 100 (%)		Elongation, %		Reduction Area, %	
		1000° F	1200° F	1000° F	1200° F	1000° F	1200° F	1000° F	1200° F	1000° F	1200° F
A	yes	93.30	85.70	70.30	67.00	75	78	19	23	49	57
B	yes	94.50	94.85	70.20	69.65	74	73	20	21	58	58
C	yes	95.50	87.40	72.70	69.90**	76	80	18	23	43	54
A	no	74.80	71.90	46.05**	48.90**	62	68	29	31	57	61
B	no	73.60	74.03	42.90**	44.60**	58	60	30	30	54	57
C	no	80.00	76.00	55.90**	56.60**	70	74	28	30	56	60

* Heat treatment: Keel block legs, 2 hr at 1650° F, air cool; 2 hr at 1000 or 1200° F, air cool
**Yield point by drop in beam. All other yield strengths reported here are by 0.2% offset method

TABLE IV—Impact Properties of Heats A, B and C*

Heat	Carbon Content, %	Charpy V-Notch Impact Strength, Ft-Lb — Room Temperature		Charpy V-Notch Impact Strength, Ft-Lb — −40° F	
		Blank	Boron	Blank	Boron
A	0.16	53(44,54,55, 58)	67(52,55,80, 81)	13(5,10,18, 21)	16(11,16,17, 20)
B	0.16	54(48,55,56, 60)	8(5,5,11, 12)	18(16,18,19, 20)	2(2,2,2,3)
C	0.18	64(56,62,64, 73)	34(28,34,35 36)	17(11,14,19, 26)	7(4,4,5,16)

*Heat Treatment: 1¼-in. Keel block legs, 2 hr at 1650° F, air cool; 2 hr at 1100° F, air cool

TABLE V—Effect of Draw Temperature on Impact Strength*

Heat	Boron Addition	Charpy V-Notch Impact, Ft-Lb — 70° F		Charpy V-Notch Impact, Ft-Lb — −40° F	
		1000° F	1200° F	1000° F	1200° F
B	yes	10(6,6,11,14)	12(6,13,14, 15)	2(2,2,2,2)	2(2,2,2,2)
C	yes	25(24,25,25, 26)	41(29,32,49, 50)	6(4,5,5,12)	7(4,7,9,9)
B	no	54(48,51,53, 63)	51(43.45,56, 60)	17(10,16,20, 21)	16(10,18,18, 20)
C	no	57(50,52,64, 64)	72(65,66,69, 88)	15(12,15,16, 18)	16(4,12,23, 24)

*Heat Treatment: Keel block legs 1¼ x 1¼ x 6½-in.; 2 hr at 1650° F, air cool; 2 hr at 1000 or 1200° F, air cool

Fig. 7a—Blank heat—contained type III sulphides plus alumina

Fig. 7b—Boron only—contained type III sulphides plus alumina

Fig. 7c—Boron plus rare earths heat contained globular type I duplex inclusions

Fig. 7—Micrographs a, b and c above show types of nonmetallic inclusions encountered in steels investigated. Magnification is X500, no etch

per-cent-brittle fracture is very gradual for both boron and boron plus rare earth tests, the temperature ranges being 150° to 10°F and 90° to 10°F respectively. This transition occurs over a large temperature range and might explain some of the scatter of impact results at room temperature.

It is, of course, possible that this type of normalized and drawn cast boron steel, with its low carbon content, is inherently subject to wide variation in impact strength. However, neither the effect of the manganese-to-carbon ratio nor the effect of different deoxidation practices on this phenomenon has been established. Further work is planned to investigate the reasons for this scatter.

Effect of Carbon on Impact Strength and Scatter—Average impact results for the three high carbon heats (A, B and C) are listed in Table IV, with the individual readings in brackets. Neither the effect of section size nor of rare earth additions was investigated for these heats. Impact strengths are similar to those of the lower-carbon heats.

Effect of Draw Temperature On Impact Strength—The effect of draw temperature on the impact strength of heats B and C is reported in Table V. Some improvement in impact strength at room temperature is effected by the higher draw temperature. No improvement occurs, however, at −40°F.

Microstructure—The types of nonmetallic inclusions encountered in blank, boron only and boron plus rare earth steels are illustrated in Figs. 7a, 7b and 7c. Type III sulphides and alumina inclusions predominated in the first two, whereas rare earth additions resulted in globular type I duplex inclusions.

The microstructural characteristics of this steel are shown in Figs. 8a, 8b and 8c. Typical fields from both 1 and 5-in. sections are shown for blank, boron only and boron plus rare earth samples. The addition of 0.003 per cent boron resulted in the formation of fine carbide, well dispersed in ferrite. The 5-in. section, because of its lower cooling rate, has more free ferrite than the 1 and 3-in. sections. This condition was observed in the steel both treated and untreated with boron. Rare earths had no effect on the microstructure.

Summary of Tensile Tests—1. Average tensile

properties of six low-carbon heats of cast boron steel were found to be as follows:

Property	Section Size		
	1 in.	3 in.	5 in.
U. T. S.	85,830 psi	84,260 psi	30,720 psi
Yield strength	68,780 psi	66,400 psi	62,020 psi
Yield Strength ÷ U. T. S.			
% Elongation	23%	23%	23%
% R. A.	58%	58%	57%

2. The ratio of yield strength to ultimate tensile strength for normalized and drawn cast boron steel was equal to that of quenched and tempered conventional steels at the same tensile level.

3. Increasing section size from 1 to 5 in. caused a moderate lowering of tensile strength.

4. Rare earth additions had no effect on tensile strength.

Summary of Impact Tests—1. Rare earth additions increased the over-all average impact strength by 16 ft-lb at room temperature and by 4 ft-lb at −40°F.

2. Impact values for this low-carbon type of cast boron steel in the normalized and drawn condition showed wide dispersion or scatter.

3. Impact strength of this steel was unaffected by section size.

4. The transition range from 100-per-cent ductile to 100-per-cent-brittle fracture for the cast steel with boron only and with boron plus rare earth was 150° to 10°F and 90° to 10°F, respectively.

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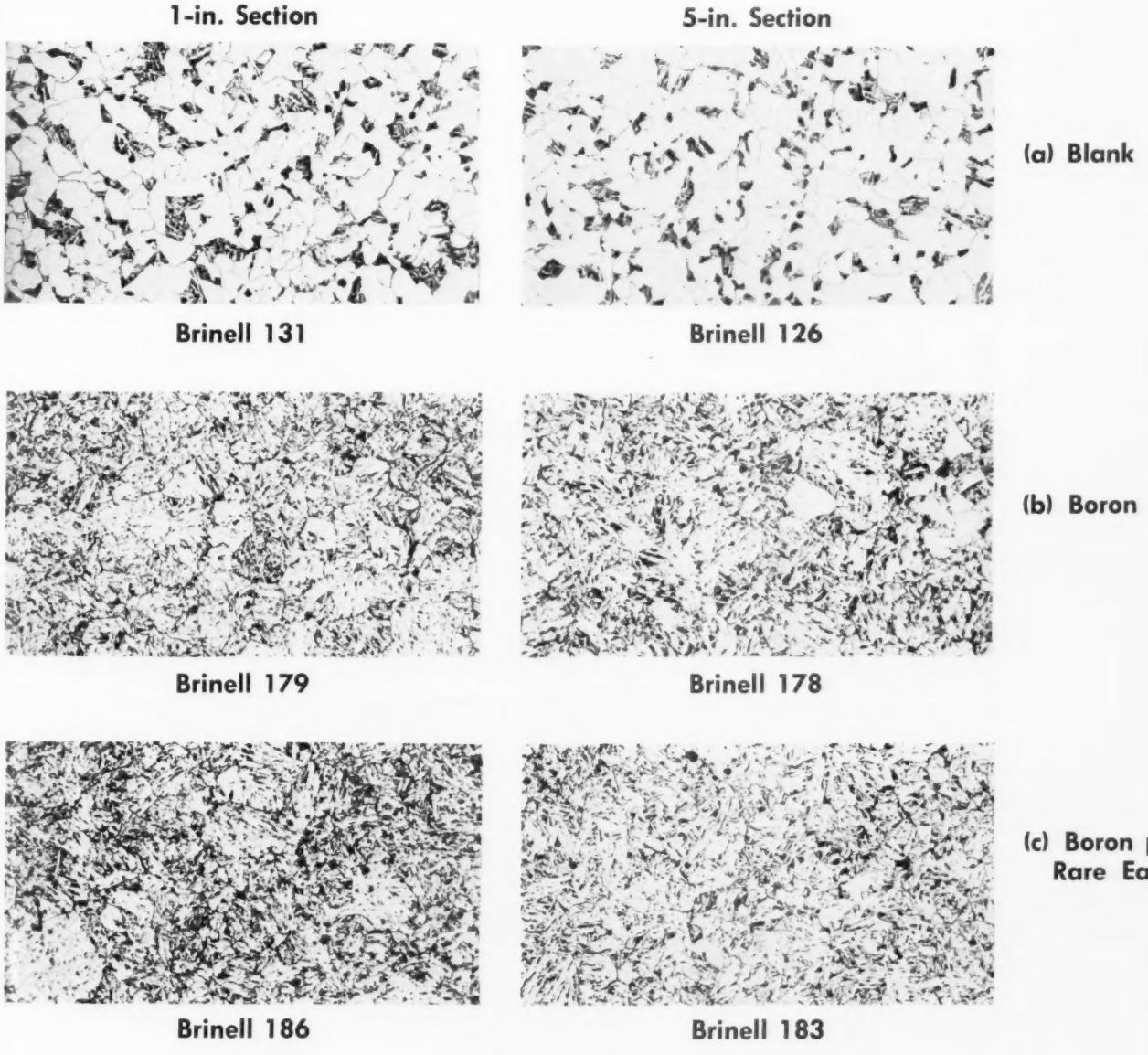

Fig. 8—Typical microstructures, showing effects of section size—8a, no boron or rare earths; 8b, boron; 8c, boron plus rare earths. All X100, 2% nital etch

Take a Fresh Look at

FOUNDRY MOLDING SANDS

Good melting and molding practices are wasted unless the molding sand can withstand thermal shock and prevent the buildup of mold pressures. Here's a hard, fresh look at molding sand fundamentals

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GOOD melting and molding practice are a waste of time and materials unless the molding sand can withstand molten metal shock and is open enough to prevent buildup of mold pressures during pouring. Sands must have workability to allow the molder to produce a green mold strong enough to permit handling, patching or trowelling and to maintain true pattern form.

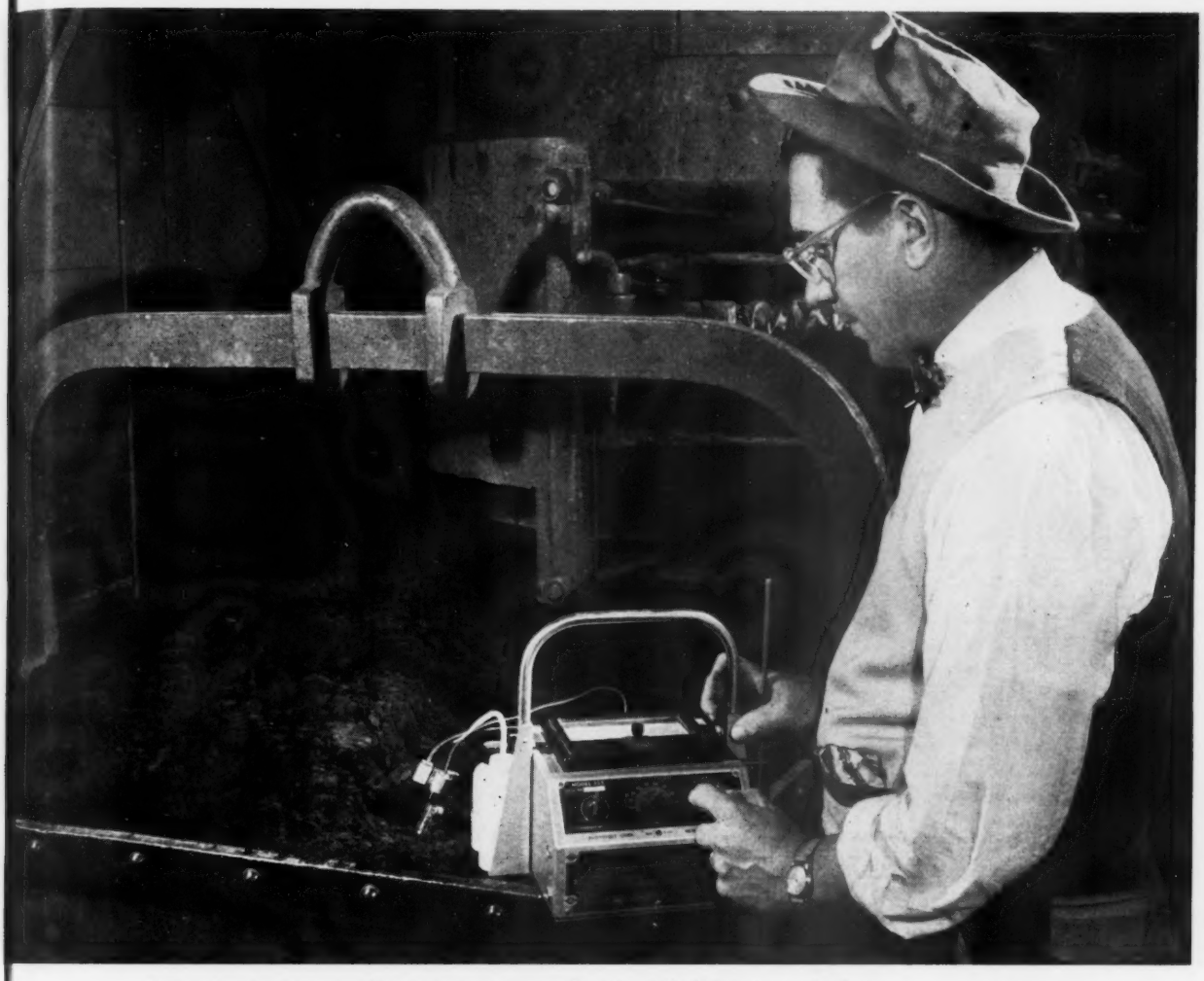
Regardless of how good the sand is, it never can produce a mold any better than the pattern. Regardless of whether synthetic or natural sand is used, the same principles and fundamentals prevail. Sands must be selected for grain size, distribution and shape. If a natural sand is employed, clay content also must be considered.

Grain size of sand greatly influences surface finish of castings. For the best surface finish possible, the smallest grain size that will give ample tolerance should be selected. Grain distribution should be such as to allow for good permeability, but still maintain a dense sand. This density must be controlled, for dense sand gives increased green strength and decreases permeability. Mold hardness usually is increased.

Ratio of Sizes is Important—Base permeability of sand depends on the ratio of sizes, the shape and the arrangement of its particles. If the sand grains are spheres of equal diameter, the volume of pore space is about 45 per cent of the total volume for cubical piling, but only 26 per cent if the grains are angular. Sand with grains of approximately equal size requires more clay bond to fill the pore space than does selectively graded sand.

When grains are about equal, shrinkage occurs until the large grains touch. After that, the plastic portion of the mass continues to shrink between the grains and may cause cracks either in drying

Large, tent-type castings were cast in dry sand. Grain size, distribution, shape and clay are vital factors in selection of a sand



Inspector is using a pH meter to test sand. He will determine whether it shows either excessive acidity or alkalinity which needs neutralizing

or when the metal is poured into the mold. This condition increases the internal pore space and causes a rough exterior surface because of the projection of grains, between which lie concave surfaces of the plastic bond. Such a condition may cause penetration or burn-in.

The greatest density is obtained by selective grading of the sand grains—that is, by using the greatest quantity of maximum-sized grains and filling the voids with the next smallest particles that do not crowd the larger grains out of their most compact arrangements. Intermediate sizes must be removed.

The medium-sized sand grains should be the maximum size possible for their position, and, in turn, their void space should be filled with smaller particles, etc., until finally the size of the bonding agent is reached. A small percentage of fines does not condemn a sand; it is when the concentration of fines exceeds some limits that trouble occurs. In some cases where sand reclaiming units are used, it is necessary to add certain amounts of fines to maintain a dense sand without excessive amounts of clay bond.

Sand Affects Metal Solidification—The thought that sand cannot promote shrinkage is misleading. Shrinkage can be attributed only to differences in metal composition, but sand does have an important influence on metal solidification and can aggravate or eliminate certain metal shrinkage conditions. Proper metal solidification, which progresses through the casting in a uniform manner, should eliminate shrinkage if feeding is correct.

Tests have shown that a dense sand subtracts heat from a casting faster than a more porous sand, for the porous or open sand acts as an insulator and holds heat, thus creating hot spots which in turn encourage shrinkage. Contrary to general belief, an open sand with a high permeability *does not* allow the hot gases to escape. Once the cavities or voids become filled with hot air, the sand functions as a radiator. Since air spaces are poor conductors of heat, the casting usually remains in a more liquid state in open sand than in dense sand, which acts as a chill.

Next in importance to the proper selection of sand is the choice of bonding material. In a natural, unblended molding sand the clay bond is uniformly distributed and can be incorporated in a foundry mixture much more easily than in a synthetic or semi-synthetic sand made with highly concentrated bonds.

The high-temperature bonding range of each type of bonding material should be understood;

Castings were produced in green sand, which gets green strength by controlling amount of moisture to below point of complete saturation of clay

fire clay has the greatest bonding range—from room temperature to approximately 2450° F. Western bentonite runs a close second with a bonding range of from room temperature to approximately 2350° F. Southern bentonite ranges from room temperature to approximately 2000° F. Cereal binders are used for low-temperature bonds, generally for green strength only since the bonding range is only from room temperature to approximately 650° F.

Because the bonding power of clay is due to its strong attraction for water, a molding sand gets its green strength by controlling the amount of moisture to below the point of complete saturation of the clay. Thus, sand particles and clay attract one another.

Western bentonite absorbs more than twice as much moisture per equal weight as other high temperature bonding clays and therefore produces a stronger bond. It can be added to natural sand for increased plasticity or used in synthetic sands by itself or blended with fire clays. A blend with fire clay is recommended to decrease the high water absorption rate of a western bentonite sand mix. A western bentonite and fire clay blended bond produces a sand mix with high refractoriness, good workability and high durability at reduced costs.

In selection of a natural sand, both grain analysis and clay content should be considered. It is easier to control clay content by using a low-clay natural sand and adding clay than by using a high-clay natural sand and adding washed silica sand. A study should be made of all ingredients used in a foundry sand so that full understanding of their particular functions is achieved. Duplication of ingredients should be eliminated. A sand mixture should be kept as simple as possible, for better control and for economic reasons.

Bond Materials Influence Flowability—Sand offers the best flowability when all grains are spheres of equal size. The denser a sand becomes, the lower the flowability. In addition, angular grains reduce flowability. The first effect of a bonding material around the sand grains is to retard the flowing action of the grains during pouring. To assume a fixed condition of packing, it therefore is necessary to apply a greater ramming force to overcome the frictional resistance imparted to the grains by a coating of bond. A bonding clay thus acts in the same direction as a spread in the size distribution of the grains. It lowers flowability, permeability and uniformity of packing within the mass. It also, however, decreases expansion forces during heating.

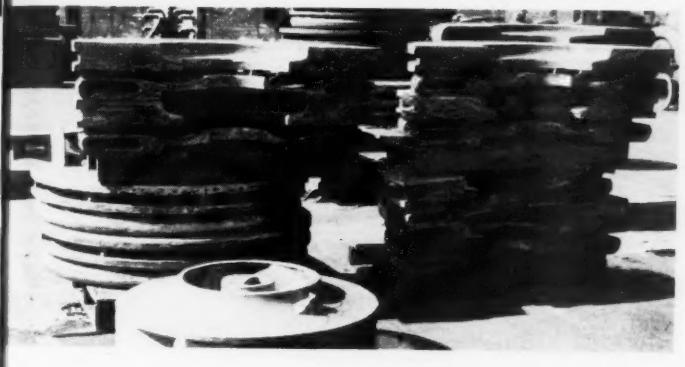
Bonding clay uniformly spread around grains merely increases their size without any basic effect on size distribution. If, however, the bonding clay is not uniformly distributed around each grain, and is in itself not completely held together, it acts in the same way as dust or fine grain particles. It completely upsets grain distribution and the properties that are dependent on it. It also fails to perform its function as a bonding material.

Clay bond loses its temper water when heated.

This loss of water is accompanied by a contraction in volume. The heated sand grain expands. With adequate balance of clay contraction and sand grain expansion, the normal displacement of sand grains during heating is prevented effectively.

The correct volume of bond in relation to the surface area of sand grains is essential. Excessive clay envelops sand grains loosely, with reduced cohesive power. With too little clay, cohesiveness also is lost and bonding ability reduced. In the same manner, too much bond reduces flowability and lowers permeability, but results in low expansion forces during heating. Too little clay increases flowability and permeability, but also increases expansion forces during heating. It therefore is important that the correct adjustment of sand, clay and temper water be made to obtain maximum cohesiveness.

The ability of clay bond to absorb and incorporate dust and other small particles may be used to advantage to improve permeability by neutralization of the fines and clay. In such a case, the amount of clay bond required bears a relationship to the amount of fine, void-filling material present in the sand. Fine materials are advantageous in increasing sand flowability and permitting a larger volume of clay without excessive stickiness in the mix because of their ability to reduce plasticity of the clay bond.



Impeller castings shown here were cast in dry sand. Cores were made of an oil sand

The property of sand flowability is the relative ability of the sand mix to behave as a liquid and to flow under the application of a ramming force. High-flowability sand requires a small ramming force to pack it to maximum density, whereas low-flowability sand requires a high ramming force.

High Flowability Gives Uniform Permeability—Since density is reflected by permeability, it also may be said that a high-flowability sand will give a mold of uniform permeability. Further, the higher the flowability, the less the variation in permeability throughout the mass of the rammed sand body.

The property of flowability can be measured readily by the change in permeability in a sand in relation to the change in ramming force. The permeability variation with ramming conveniently has been called the ventability of the sand. Sand that reaches its maximum packing relatively easily has a high ventability. This fact is perfectly in keeping with the basic theories of sand grain shape and distribution and clay bond conditions and distribution that already have been discussed.

The degree of strength change with ramming has, for convenience, been called bondability. The properties of ventability and bondability are the connecting link between sand properties, degree of ramming and final mold properties. They are themselves a perfect expression of flowability, which is the most fundamental asset of a molding sand. If a sand does not possess flowability, it cannot be molded under the application of a ramming force.

High Ventability Is Desirable—It has been found in practice that a sand which exhibits higher ventability than bondability is a good molding sand and is likely to be free from buckles, scabs and allied defects. If a sand has high ventability, the decrease of permeability with increased ramming is low. This statement means that the grains pack together well and are not in a position to accommodate themselves by relative movement when expansion of the silica grains due to heat takes place. If the strength of the sand mold is insufficient to offset the resultant expansion forces or gas pressure forces, however, rupture of the mold surface and a defect occur.

The bondability of sand indicates the relative strength of the mold with any degree of ramming. When ventability is lower than bondability, expansion and gas pressure forces due to close packing increase at a rate greater than strength increases to offset them. This condition is conducive to casting defects.

A sand mix consists essentially of sand grains and clay bond. Auxiliary materials sometimes are used to secure the wide variety of sand and mold characteristics necessary for particular molding operations. These materials may be binders, surface-finish agents or clay-condition adjusters. In any case, their use is not fundamental to sand behavior, but is entirely for the purpose of adjustment of fundamental sand behavior.

Surface-finish agents may be refractory and may be applied to the surface of the mold, or they may be incorporated in the sand mix. They improve surface finish by providing gases which are reducing in character and inhibit chemical fusion between metal and sand grains.

Agents for improved safety usually are designed to reduce expansion forces during heating. They do so by virtue of their cushioning action during the ramming operation and, if they are combustible like wood flour, by providing voids during the casting process.

In summary, the fundamental basic theory of molding sands is dependent on grain size and clay bond characteristics. The latter in turn, control flowability, hot strength and surface finish. All of these properties are modified by the use of auxiliary materials.

Questions and Answers

Loss of strength in stored cores may be due to neglecting to bake them . . . Plans to add limestone in cupola operation . . . Zinc loss in melting yellow brass is much too high . . . Wants to cast liners centrifugally . . . Gangway material . . . Malleable rims

Storage Causes Strength Loss

QUESTION Recently we ran into a peculiar circumstance in that some small cores stored over the week end weakened considerably. Cores are made from a 35 AFS grain fineness sand with 1 per cent cereal and 1 part core oil to 30 parts sand. Weather was not too damp. Could the trouble possibly be due to an inferior core?

ANSWER We gather that your past experience with the particular core mix has been satisfactory and the cores in question were too fragile to handle. It is doubtful that absorption of moisture had anything to do with this unexpected condition particularly with the high oil-to-sand ratio you are using. Cores with a much lower oil-to-sand ratio have been stored for long periods without any difficulty. It hardly seems possible that all of the core oil was left out, and even if only half the oil was used, the cores should have stood up reasonably well. Hence, there are only two possibilities left. One is that the cores were not baked sufficiently, the other that the cores were not baked at all. Unbaked cores exposed to the air for any length of time will have a hard skin formed on the surface which might lead one to think that they had actually been baked.

Limestone Addition to Cupola

QUESTION We have a small cupola 28 in. in diam which we operate once or twice a week on 3-hr heats and would like to know how much limestone we should use. We use 600 lb of coke for the bed with 1000-lb iron charges and 150-lb coke splits. How much stone should be used at the beginning and between charges? Should limestone be used only on the original charge or between each charge? Also, should the slag hole be open during pouring?

ANSWER In general, the amount of limestone used between charges is about 3 per cent of the weight of the metal charge with double that on the bed coke. Preferably, the stone is placed near the center, away from the lining. You mention that you are using a 1000-lb iron charge, but possibly you might secure better results by using a 500-lb charge. Also you apparently place the bed by weight, but it will be better to place it by volume so that it always is the same height above the tops of the tuyeres—in your case, around 36 in. It may be well to experiment to find the best bed height.

The slag hole should be opened as soon as the slag rises a few inches above the hole, then left open. Slag height can be determined by keeping a close watch at the tuyeres, and, of course, the slag hole should be opened before the slag reaches the tuyeres. After a short number of heats, and after observing the time it takes for the slag to rise to the proper point, you can eliminate watching and open the slag hole at a definite time after the wind goes on.

Speeds for Grinding Wheels

QUESTION We would like to obtain some information on suitable grinding wheel speeds as used in your country. We operate resin-bonded wheels at a speed of 45 meters per second and vitrified wheels at a rate of 25 meters per second. Also how do the capacities of the two types of wheels compare?

ANSWER Usual peripheral speeds of resin-bonded wheels range from 7000 to 9500 sfm or 35.5 to 48.3 meters per second. Speeds for vitrified wheels range from 5000 to 6000 sfm or 25.3 to 30.5 meters per second. Hence, your resin-bonded wheels are operating near the top of the range, and the vitrified wheels are operating practically at the lowest range. Probably the speed of the latter could be increased to about the middle of the range to advantage.

Resin-bonded wheels of the proper grain size and structure usually have a higher metal removal rate due to higher surface speed, but time of contact and the pressure between work and wheel have an important bearing on the results with both types of abrasive grinding wheels.

The only way to determine wheel economy is to run experimental tests under closely controlled conditions. Weighing the wheel before and after the test run will give the amount of abrasive used. Weighing the castings before and after grinding or snagging will indicate the amount of metal removed.

Seems To Have High Zinc Loss

QUESTION We make a large volume of yellow brass plumbing castings, many of which have thin sections, and it appears that we have a high zinc loss since we add from 5 to 10 per cent zinc. We melt in No. 70 and No. 90 crucibles in oil-fired pit furnaces as well as in a tilting-type unit with a No. 125 crucible. Can you tell us the time to add the zinc? Also, can we melt in the tilting furnace and pour off with the smaller crucibles? If so, at what temperature should the metal be held? We add a small piece of aluminum just before pouring. Is that good practice?

ANSWER Possibly you are getting your metal too hot in melting or are adding more zinc than actually is lost. In general, zinc loss is believed to be from 1½ to 2 per cent, and in ingot an allowance in the zinc content is made by the ingot producer. With light scrap as the major part of the charge, the loss would be somewhat higher. By determining the zinc content of the raw material and of the melt, you can ascertain the actual zinc loss.

Perhaps the best procedure would be to make a temperature survey to find out the best pouring ranges for the different types of castings which will produce solid castings free from cold shuts. Also, determine what the temperature loss is between furnace and mold side. With that information you can establish the proper melting temperatures in the pots, and when those are reached, the pots should be pulled and poured. Zinc melts at the relatively low temperature of 787° F and will dissolve rapidly in molten brass. It therefore is added just a few minutes before the pot is pulled.

Addition of a small amount of aluminum to yellow brass appears to suppress evolution of zinc fumes due to formation of an aluminum oxide skin. It also is said to provide better flowing characteristics and gives a bright appearance to the castings.

However, aluminum is not generally used in yellow brass for pressure work unless special precautions are observed in gating and in pouring. The aluminum oxide skin previously mentioned has a tendency to form inclusions unless the pouring is conducted smoothly, without break, and the gating system is such that turbulence is eliminated or held to a minimum.

Spinning of Cylinder Sleeves

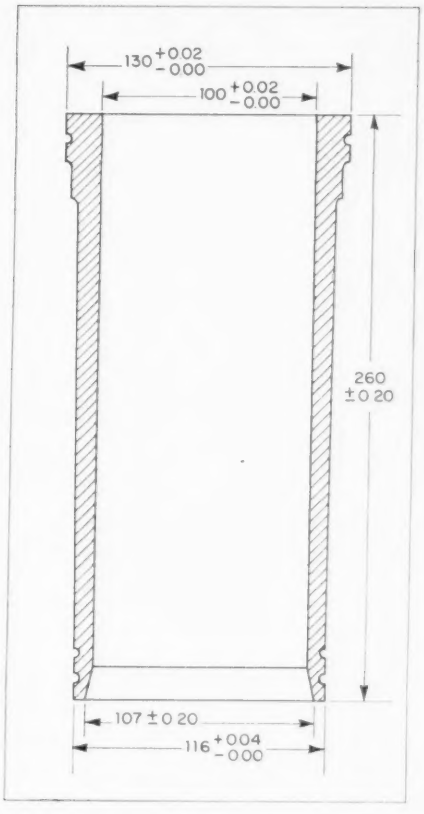
QUESTION In our foundry in Spain we are making a small diesel engine and we want to cast the cylinder sleeves centrifugally. We would like to have some suggestions as to iron composition, speed of the mold, its shape, protective coating for the mold, etc.

ANSWER Your sketch shows the upper flange as 130 mm OD, the lower end 116 mm OD, the bore 100 mm, and the length 260 mm. If good melting practice is employed to obtain clean hot iron, we believe that you can obtain the desired final dimensions from a rough centrifugally poured casting whose several dimensions are increased 5 mm each, except for the bore which is decreased by that amount. In other words the OD at the flange should be 135 mm, the OD at the bottom 121 mm, the length 265 mm, and the bore 95 mm.

The exact allowance for machining and grinding, however, will have to be determined by carrying on those operations on the liner or sleeve and observing whether or not the requirements can be met. If the suggested allowance is insufficient, changes can be made without much difficulty. For example, if the OD allowance is not sufficient to clean up satisfactorily, the size of the mold cavity can be increased the desired amount. If the ID does not clean up, then the hole in the cover plate fastened to the mold which governs the wall thickness of the casting can be decreased to provide the desired increase in the wall.

Such sleeves may be made on horizontal axis or on vertical type machines with the axis inclined 30 degrees. With the former machines spinning speed should be around 1000 rpm, while with the latter machines about 800 rpm. The most satisfactory operating speed should be determined by experiment. Mold surfaces are protected by a thin refractory clay wash which preferably is sprayed on to obtain a uniform coating. When coating is applied, the mold should be just hot enough to result in immediate drying, but not hot enough to cause boiling and blistering.

Compositions for cylinder sleeves cover a wide range, at least in this country, and usually contain Cr, Ni, Cu, Mo, etc. in various combinations. For example, one firm uses a composition containing 2.90 to 3.50 per cent TC, 1.80 to 2.50 per cent Si, 0.20 to 0.80 per cent Cr, and 0.25 to 1.0 per cent Cu or Ni. Another composition



Drawing shows finished dimensions of cast iron liner for diesel engine use

shows 0.60 to 0.70 per cent Mo and 0.40 to 0.50 per cent Cr while a third contains 0.55 to 0.75 per cent Cr with 1.80 to 2.20 per cent Ni.

Some of the sleeves are heat treated, and others are not, the choice depending largely on composition and final desired properties. One heat treatment includes raising the temperature to 1000 — 1100° F to relieve stresses and improve machinability. After machining the castings are heat treated at about 1550° F, quenched in still oil and then drawn at 350 to 370° F.

Material for Foundry Gangway

QUESTION Our foundry gangways need renewal and repairs. What is a good material that will withstand hard wear and resist the spillage of hot iron?

ANSWER Various materials are used for foundry floors. One recommendation is a concrete base with a finishing top about ¾ to 1-in. thick composed of a mixture of 1:2 neat cement and 40 to 60 mesh silica sand.

One proprietary material for surfaces employs a metallic aggregate while another uses an abrasive aggregate. Still another procedure is use of hard-burned brick such as used for paving which are laid on a concrete sub-base. A 1-in. layer of sand is placed on that and the brick placed in position. Then a thin cement grout is brushed over the surface to fill the joints and cement the bricks tightly together.

Malleable Iron Contains Rims

QUESTION While we operate gray iron foundries producing castings for our own use, we purchase our malleable iron casting needs from outside sources. In connection with the latter we have run into a problem in that in some of the castings we find a pearlitic layer from 0.010 to 0.070-in. wide around the periphery of the castings about 0.030-in. from the skin. Certain fatigue tests we have made on castings with and without this pearlitic layer indicate that it has an adverse effect on fatigue properties. One casting having this pearlitic layer failed after 30,000 cycles while another free from pearlite is still under test after 450,000 cycles. Other mechanical properties of the two castings are more or less the same. We are interested in knowing: 1) Is this layer of pearlite known to have detrimental effects on the properties of blackheart malleable iron castings, and if so, what? 2) Is this a common occurrence, and something we should expect in the regular run of the mill commercial castings, or is it something that can be avoided by good foundry practice?

ANSWER While not specifically mentioned, we assume that the outer 0.030-in. of the casting is a ferrite rim followed by the pearlite rim 0.010 to 0.070-in. deep, and it appears to us that the rims you mention are extremely deep. Ferrite rims are caused by ordinary decarburization and can be controlled by use of less oxidizing atmospheres in annealing, particularly in the first stage. Pearlite rims present more of a problem because they almost always are present

in some degree. To minimize them, the analysis is adjusted to give an easily graphitized iron.

Your first question can be answered only after making certain assumptions. One thing of interest is the question as to where the fatigue crack starts. In homogeneous alloys, the crack starts at the highest stress, which usually is at the surface. Case-hardened steels in fatigue often have the crack starting in the unhardened metal at the edge of the case because the case is strong enough to resist the maximum stress, but the base metal cannot withstand a lower stress.

If the rim on malleable iron is pearlite, the conditions will be parallel to case-hardened steel—a center of metal with one fatigue strength and a rim of higher fatigue strength. In such a case the rim only could improve fatigue resistance even if the conditions were such that a crack did start from the surface.

If, as we suspect, the outer rim is ferrite, it will have a fatigue strength about equal to that of the interior, and even if the highest stress occurs in this rim it will not lower the fatigue resistance of the casting. However, there is one fly in the ointment. When decarburization has been as great as it appears in this case, the ferrite layer often is loaded with sonims (oxides, etc.) which decrease the strength of the ferrite. In very bad cases they may form the equivalent of stringers normal to the surface. In any case, these sonims can be the cause of a crack early in the fatigue test. Once the crack is formed, complete failure is only a question of time.

The only suggestions which can be offered are: 1) Do not decarburize badly. 2) Tumble or shot-blast all castings. 3) Check the design for inherent stress raisers. The last two suggestions follow normal practice in fatigue problems.

Centrifugal Casting Machines

QUESTION We are considering the possibility of establishing a centrifugal casting department in our small foundry in Mexico which produces gray iron and nonferrous castings, and will appreciate any information on the machines.

ANSWER In general, two types of centrifugal casting machines are employed—one spinning on the horizontal axis and the other on the vertical axis. The horizontal machines are used mainly to produce tubes or pipes where the length greatly exceeds the diameter.

The vertical axis machines are employed to make short tubes, rings, bushings, etc. They also are used to produce a number of small castings which are located radially around the central pouring sprue. Molds used for producing such castings usually are baked core-sand type, and a number of molds may be placed or "stacked" on each other with the central sprue running from top to bottom mold.

The machines are arranged so that they may be operated at different speeds to effect a definite centrifugal force on the casting or castings being made—usually from 50 to 75 times that of gravity (50 to 75 G).

Core Oil Content Is Too High

QUESTION We are using aluminum core driers and after a few passes through the oven they become covered with a scale composed of burned sand. At present we do not remove it as it takes too much time, but the cores of course, have a rougher finish as well as not being dimensionally correct. Can you tell us how to prevent this scale formation, or a quick method for removal?

ANSWER It is our opinion that your difficulty with scale formation on your core driers results from use of too much core oil binder in your sand mixture. Make a careful study to determine the proper amount of oil to be used; you may be able to save on core cost and also eliminate scale formation.

Since core oil weighs about 2 lb per qt, we suggest you mix up an experimental batch, using 160 lb sand and 1½ lb cereal with 1 qt oil, which will give a ratio of about 1 to 80 by weight. Try it with a variety of cores and see what results are obtained. If the cores are too fragile, the amount of sand can be reduced gradually until the desired results are obtained.

To remove the scale, it is suggested you try any of the numerous alkaline cleaning agents recommended for aluminum.

Permanent Mold Material

QUESTION We have noted in FOUNDRY many questions and answers which have been helpful in our brass foundry, and now we have a question. What materials would be best for centrifugal permanent molds for production of bushings in our brass foundry? Please include the relative merits of each.

ANSWER Material most commonly employed for manufacture of permanent molds for either centrifugal or static casting is gray cast iron, preferably high-carbon type, which is reported to have better resistance to thermal shock. Mild steel molds are used to some extent.

For short-run work where the number of castings involved will not justify the cost of a metal mold, graphite molds are serving satisfactorily. Graphite can be machined easily and rapidly, but since it is a soft material, it can be scratched and marred. However, with careful handling, especially in extracting the castings from the mold, a reasonable life can be obtained.

While we do not have any definite information on life of steel molds as compared to gray iron molds, we would expect that the steel molds would have a longer life commensurate with the higher cost of the material. Gray iron molds will machine more easily than steel molds. In any case, both types of molds will have to be coated with refractory washes for protection of the surfaces as well as to assist extraction of the castings.

Castings Are Not Machinable

QUESTION We are having some difficulty with some aluminum bronze castings we made. They were made in two lots with an analysis of about 83.1 per cent copper, 4.75 per cent iron, 11 per cent aluminum and 1.1 per cent manganese. Castings were heat treated by an outside firm, and one lot was machinable, but the other was not. Can you offer any suggestions on why the one lot is unmachinable?

ANSWER Assuming that the compositions of the two lots of aluminum bronze were the same, the difference of machinability is due to variation in heat treatment. While you do not mention the latter procedure, it probably includes heating to around 1350° F, quenching and then drawing or tempering in the range 930 to 1230°F. Hardness and tensile strength, of course, are highest in the quenched state, but usually the casting—in addition to containing stresses from quenching—tends to be low in yield strength and elongation.

The drawing operation reduces the stresses, increases the yield strength and elongation, and decreases the hardness. In the temperature range mentioned for the drawing operation, indications are that the tensile strength is little affected, the yield strength and elongation are measurably improved, and hardness is at the minimum.

Therefore, it appears that possibly the castings which were not machinable were not subjected to the drawing operation after quenching; or the temperature of the drawing operation may not have been high enough to accomplish the desired reduction in hardness. Experimentally, you could take one of the hard castings, heat it to a red heat and allow it to cool. Then try filing or machining the piece.

A typical Iroquois product . . . a marine motor housing.

"We recommend this machine to all foundries"

Says Mr. Walter Vierthaler, Vice-President of Iroquois Foundry Co., Racine, Wisconsin, where high quality grey iron castings are produced. Here approximately 300 tons of mulled sand are conditioned each night with a Royer NYP-E Sand Separator & Blender.

Front end loaders deliver the sand from the muller to the molding station. The original practice was to dump this sand on the molders heap, caked and packed from mulling and bucket loading. Now the sand is charged into the large hopper of The Royer instead. No time has been added to the cycle of operation, but the molders heap has been transformed to a cool fluffy pile. When one floor is completed, the highly portable Royer is moved to the next. Scrap loss and cleaning room time are down and casting finish has been improved.

All mulled sand can be vastly improved by proper aeration and fluffing. The best place for this operation is at the molding station where the sand will not be compacted by further handling prior to the molding operation. For a bucket loader type of operation we recommend the new Royer NY series. Write for bulletin NY-54 today.

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Men of Industry

J. C. GORE
. . . retires, A-D-M Co.

HERBERT F. SCOBIE
. . . NFFS field manager

S. J. MORAN
. . . v. p., foundry operations

MILTON D. EMERY
. . . AFS Chapter Chairman

J. C. GORE, Chicago manager, Foundry Products Div., Archer-Daniels-Midland Co., Cleveland, will retire Sept. 1, after 49 years in the foundry supply business. He was associated with Birmingham Coal & Iron Co., Birmingham, later absorbed by Woodward Iron Co., from 1907 to 1912, when he joined Domhoff & Joyce Co., Cincinnati, pig iron and coke sales agent. In 1913 he was transferred to the company's Indianapolis office as a salesman and became one of the first to introduce by-product coke as a foundry fuel. In 1924 Mr. Gore became associated with St. Louis Coke & Iron Corp. as assistant sales manager in Chicago and 2 years later was named sales manager in the St. Louis home office. He resigned in 1930 to become Chicago manager, Werner G. Smith Co., Cleveland, later the Werner G. Smith Division of A-D-M, and subsequently the Foundry Products Division. Mr. Gore was president of the Chicago Chapter of the AFS in 1945-46.

Dr. Russell C. Buehl, formerly chief of the Bureau of Mines Pyrometallurgy Laboratories in Pittsburgh, has joined Rem-Cru Titanium Inc., Midland, Pa., to study and develop new melting techniques for titanium alloys. Dr. Buehl received his doctor's degree of science from Massachusetts Institute of Technology, where he taught and conducted industrial research until 1939. After four years as a Fellow of Mellon Institute, he joined the Pyrometallurgy Laboratories in Pittsburgh.

Herbert F. Scobie, until recently editor of *Modern Castings,* has joined the Non-Ferrous Founders' Society, Chicago, as field manager. After graduation from University of Minnesota in 1935, he remained there as foundry consultant and instructor in foundry practice and chemistry until 1945, when he assumed charge of educational activities of the American Foundrymen's Society, Chicago. Since 1948 he had been engaged in publication work of the AFS.

S. J. Moran was named vice president-general manager, foundry and mill machinery operations, and **E. C. Rook,** vice president-general manager, fabricated products operations, Blaw-Knox Co., Pittsburgh, following integration of the company's manufacturing operations. Mr. Moran joined the company in 1920 and formerly served as vice president-general manager of the Union Steel Castings Division, Pittsburgh. Until recently he was in charge of operations at Lewis Machinery Division, Groveton, Pa. Mr. Rook has been vice president-general manager of the Blaw-Knox Equipment Division, Blawnox, Pa., since he joined the company in 1954.

J. B. Nordholt, formerly president, Webster Mfg. Inc., Tiffin, O., has been named chairman of the board of directors, succeeding **Arthur L. Hossler. J. B. Nordholt Jr.,** was elected president; **C. S. Jones,** vice president-engineering; **J. S. Nordholt,** vice president-manufacturing; and **Harry E. Byrne,** secretary-treasurer.

Milton D. Emery, chairman of the Western New York Chapter of the AFS for the current year, is production manager, Buffalo Pipe & Foundry Corp., Buffalo, N. Y. He joined the company in 1952, after 20 years with United States Radiator Corp., Detroit. Mr. Emery was vice chairman of the Western New York Chapter last year.

Clarence A. Bever, for 26 years superintendent of foundries at Bethlehem Steel Co.'s plant in Bethlehem, Pa., retired July 1, and has been succeeded by **Karl H. Kostenbader Sr. Jesse H. Muir** was named superintendent, and **James C. McKerihan,** assistant superintendent, of the steel foundry. **Amos L. Proctor** was appointed assistant superintendent of the brass foundry and **John B. Stevens,** assistant superintendent of the iron foundry.

Calbraith P. Champlin Jr., formerly assistant to the president, Strong Steel Foundry Co., Buffalo, was appointed assistant plant manager. **Gerald T. McKee,** assistant sales manager, was named sales manager.

Carl E. Allen, since 1950 president of Campbell, Wyant & Cannon Foundry Co., now a division of Textron American Inc., has been elected president of the Federal Reserve Bank of Chicago.

Wayne Belden was re-elected president, Ajax Flexible Coupling Co., Westfield, N. Y., at the company's recent annual meeting. **William T.**

Growing Sales of

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So favorable has been the reception given uniform Woodward iron by the nation's foundry trade in recent years that Woodward has increased its production capacity approximately 45% since 1950. It has likewise invested more than $14 million to improve its facilities and better its service to customers.

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Woodward Iron Company

WOODWARD, ALABAMA

Independent Since 1882

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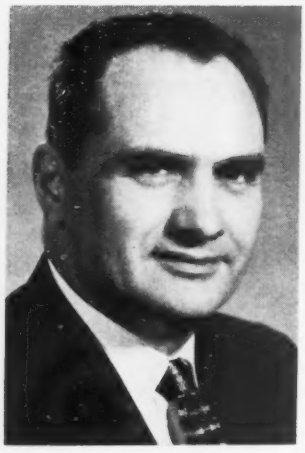
MEN OF INDUSTRY



RAY OLSON
. . . pattern works v. p.

GORDON L. SCHUSTER
. . . Despatch Oven Co. pres.

ARNOLD S. GROT
. . . chief metallurgist

A. JAMES FISHER
. . . Metal & Thermit sales mgr.

Welch is chairman of the board. Other officers are: **Harley E. Northrop,** executive vice president; **Charles W. Belden,** vice president; **Robert G. Cady,** treasurer; and **Thomas H. Brumagin,** secretary.

Ray Olson has joined Southern Precision Pattern Works Inc., Birmingham, as vice president. Mr. Olson was formerly vice president-sales, Shell Process Inc., and sales manager, Production Pattern & Foundry Co., both of Chicopee, Mass.

Gordon L. Schuster, since 1947 vice president and chief engineer, Despatch Oven Co., Minneapolis, was elected president and general manager. He joined the company in 1940 and became chief engineer of the Industrial Furnace Division in 1943.

Arthur C. Buesing has joined Gray Iron Research Institute Inc., Columbus, O., as foundry engineer. For the past 4 years Mr. Buesing was sales engineer, Modern Equipment Co., Port Washington, Wis.

Kenneth F. Ebbeson was appointed abrasive engineer in the Boston area, Norton Co., Worcester, Mass., succeeding **Sidney B. Wetherhead,** who has been named manager of distributor sales. A graduate of Rensselaer Polytechnic Institute, Mr. Ebbeson has been with Norton since 1946, as a grinding engineer in the sales enginering department.

John P. Cartwright was named manager of industrial sales, Joy Mfg. Co., Pittsburgh. A graduate of U. S. Naval Academy, he joined the company in 1950 and later became sales representative in Washington. **Arnott J. Lee** succeeds Mr. Cartwright as Washington district manager. Mr. Lee a graduate of University of North Dakota, has been engaged in sales work and sales promotion since joining the company in 1934.

Arnold S. Grot was named chief metallurgist, Edward Valves Inc., subsidiary of Rockwell Mfg. Co., East Chicago, Ind. A graduate of Purdue University, he joined the company 10 years ago. Previously he was chief metallurgist, Taylor Forge & Pipe Works, Cicero, Ill.

A. James Fisher has been named general sales manager, Metal & Thermit Corp., Rahway, N. J. He was graduated from Princeton University and joined the company in 1955 as technical advisor to the president. Previously he was associated with U. S. Industrial Chemicals Inc., New York, and U. S. Polymeric Chemicals Inc., Stamford, Conn.

Thomas W. Pangborn, president, Pangborn Corp., Hagerstown, Md., has been awarded an honorary degree of doctor of science by Catholic University of America, Washington.

E. E. Troyer was recently elected president, Tamms Industries Inc., Chicago. With the company since 1934, Mr. Troyer became vice president in 1944 and was named executive vice president the following year.

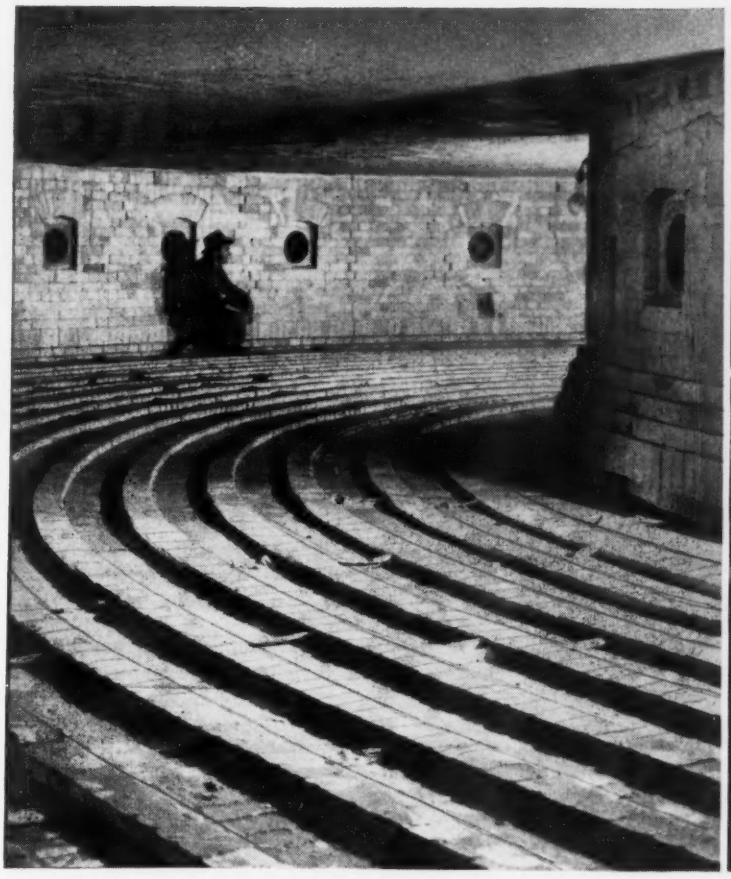
ARTHUR C. BUESING
. . . joins research institute

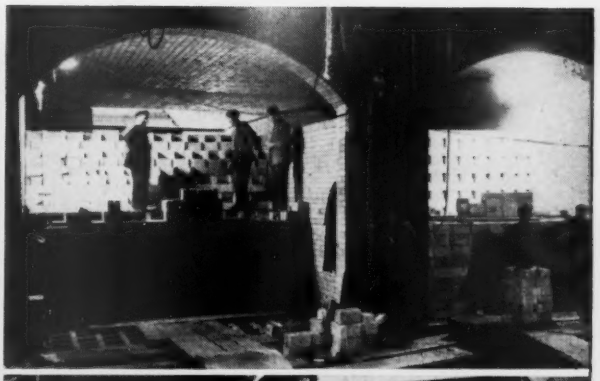
KENNETH F. EBBESON
. . . Norton Co. abrasive sales

JOHN P. CARTWRIGHT
. . . industrial sales mgr.

E. E. TROYER
. . . heads Tamms Industries

Profitable trends in the use of refractories





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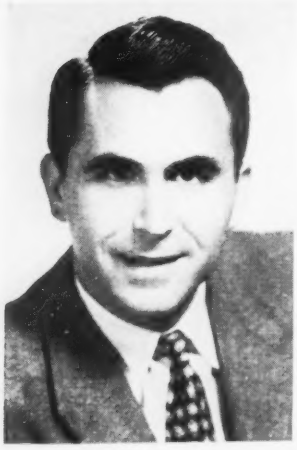

SAM D. McKINNEY
. . . Hyster sales promotion

JACK P. GREER
. . . becomes district mgr.

J. WILLIAM MITCHELL
. . . AFS chapter president

JAMES T. ROBERTS
. . . sales division mgr.

Mrs. Frieda Gerretson has been elected treasurer of the company, and **H. P. Barber,** secretary.

Jack P. Greer was appointed manager of the Mid-Central district for Hyster Co., Portland, Oreg. A graduate of Knox College, Mr. Greer joined the company in 1954 and recently handled retail sales in Chicago. **Sam D. McKinney** has joined Hyster's sales promotion department to engage in development of training programs and material for the company's dealer salesmen.

Fred M. Menzel, elected chairman of the Oregon Chapter of the AFS for 1956-57, is manager of the Portland plant of Rich Mfg. Co., Los Angeles. He joined the company's engineering department in 1948, was transferred to the Portland branch in 1951 as plant engineer, and was named plant manager in 1954.

Arthur Woods, formerly assistant to the managing director, Polygram Casting Co., London, was appointed European manager, Shallway International Corp., Palo Alto, Calif., foundry sales and service company for Shalco shell molding and coreblowing equipment. With temporary offices in Dusseldorf, Germany, Mr. Woods will supervise sales and service throughout Europe, Africa and the Middle East. **Forest G. Boucher** was appointed service co-ordinator, Shallway Corp., at the company's demonstration center in Connellsville, Pa. Mr. Boucher was formerly associated with Penn-Scott Foundry, Scotidale, Pa., and the former Columbia Foundry, McKeesport, Pa.

J. William Mitchell, elected president of the Southern California Chapter of the AFS for the current year, since 1954 has been superintendent, Utility Steel Foundry, Vernon, Calif. He joined the company in 1941 and served as furnace helper, melter, expediter, co-ordinator and assistant superintendent. Mr. Mitchell has been active in committee work of the Steel Founders' Society of America and American Institute of Mining and Metallurgical Engineers. He has served as a director, treasurer and secretary of the Southern California Chapter and was its vice president last year.

James T. Roberts has been named sales division manager, Cleco Division of Reed Roller Bit Co., Houston, Tex., in its North Central sales area. Division headquarters are in Chicago. He was formerly a senior salesman for the division.

William B. Hicks, project specialist in the development department, Organic Chemicals Division, Monsanto Chemical Co., St. Louis, was appointed manager of the department's plasticizer's, resin materials and paper chemicals section. Mr. Hicks joined the company in 1946 as a chemical engineer in the company's Central Research Department, Dayton, O.

Frank J. Vuranch was named chief service engineer, Foundry Equipment Co., Cleveland. An engineer in the

FRED M. MENZEL
. . . Oregon Chapter chairman

ARTHUR WOODS
. . . Shallway European mgr.

FOREST G. BOUCHER
. . . joins Shallway Corp.

FRANK J. VURANCH
. . . chief service engineer

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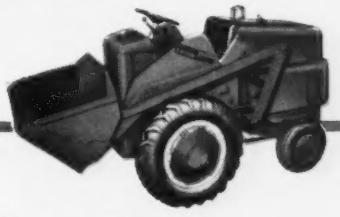

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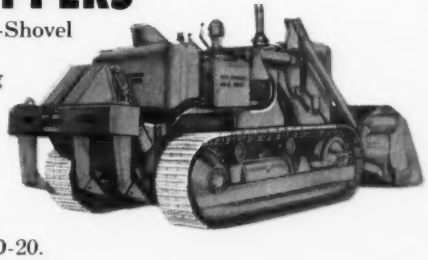

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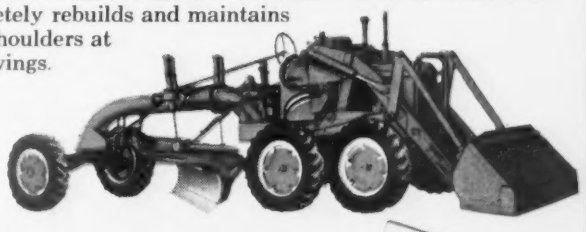

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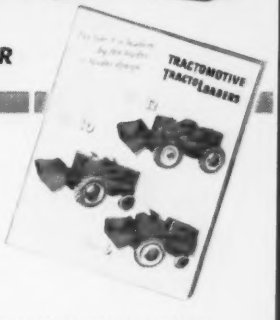

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MEN OF INDUSTRY

CARL BEERS
. . . manufacturer's agent

ALBERT M. NUTTER
. . . heads New England Chapter

DEAN STRAND
. . . joins Bay State Abrasive

GEORGE J. BARKER
. . . Wisconsin Chapter pres.

Merchant Marine during World War II, Mr. Vuranch joined the company in 1951 as a service engineer.

Carl Beers, manufacturers' agent, has been appointed to represent Carl Mayer Corp., Cleveland, in the Michigan area, and International Molding Machine Co., La Grange Park, Ill., in the eastern Michigan area. Mr. Beers has been engaged in equipment sales for 20 years.

William Thorrat has been named manager of a new branch office established in Houston, Tex., by Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill. **Harold S. Hern** has joined the Baltimore sales staff, and **John C. Twomey** was named sales engineer in Boston. **Walter A. White, Robert G. Steel,** and **T. J. Chakos** have joined the Chicago sales office, and **Henry T. Clinkaberry** and **Robert D. Getzelman** have been appointed service engineers in the Los Angeles office. **Charles E. McGoff** has been named service engineer in the St. Louis office of the division.

Harold F. Fiegenschuh, director of purchases, Continental Foundry & Machine Division, Blaw-Knox Co., has retired after 44 years with the organization. **D. S. McCleary,** formerly Pittsburgh district purchasing agent for the division, has been named assistant director of purchases for Blaw-Knox. **Wayne Rawley Jr., H. P. Bork,** and **B. R. Lauer** have been promoted to staff purchasing agent for Blaw-Knox.

William E. Whitehouse was appointed representative in New Mexico, Colorado, Nevada, Utah, Wyoming and Idaho for Laclede-Christy Division, H. K. Porter Co., St. Louis, with headquarters in Denver. A graduate of University of Nevada, he was previously associated with Kaiser Steel Corp., Oakland, Calif.

Albert M. Nutter, elected president of the New England Chapter of the AFS for 1956-57, has been treasurer and general manager of E. L. LeBaron Foundry Co., Brockton, Mass., since 1949. A graduate of Harvard University, he was president of Old Colony Foundry Co., East Bridgewater, Mass., from 1939 to 1942. After military service he became superintendent of the LeBaron foundry in 1946. Formerly a director of the New England Foundrymen's Association, he was named its president earlier this year and continued in that office when the association recently became the New England Chapter of the AFS. He is a director of the Gray Iron Founders' Society.

William K. Myers was named New York district manager, the Jeffrey Mfg. Co., Columbus, O., succeeding **R. W. Sweitzer. Tom Fear Jr.** was appointed St. Louis district manager, replacing **Harley Lee,** who will continue in an advisory capacity. **William T. Davis,** formerly of the Houston, Tex., office, was transferred to San Francisco as application engineer. **William A. Lewis** was named sales engineer in Houston, and **Ralph Bolton,** sales engineer in Birmingham. **James A. Frazier** was assigned to the industrial sales division, Beckley, W. Va. Other appointments include: **John Chrystal,** manager of the Columbus, O., office replacing **C. O. McFadden,** who continues in an advisory capacity; **A. T. Loew** has succeeded Mr. Chrystal as manager of original equipment sales in Columbus; **Dick Ross** has assumed Mr. Loew's former position of office manager.

Dean Strand was appointed abrasive engineer for the Fox Valley and Rockford, Ill., area, Bay State Abrasive Products Co., Westboro, Mass. He had been associated with Robt. W. Hoffman Co., Chicago, as distributor for Bay State Abrasive.

George J. Barker, president of the Wisconsin Chapter of the AFS for the current year, is professor of metallurgical engineering, University of Wisconsin. A graduate of the university, he has been a member of its faculty since 1921, and while chairman of the Department of Metallurgy was instrumental in enlarging the foundry curriculum and installing a new foundry laboratory. In 1953 Prof. Barker was awarded an honorary life membership in the AFS in recognition of his promotional work in the field of foundry education. He is a former chairman of the Educational Division of the AFS and was instrumental in starting the program of the Foundry Educational Foundation at Wisconsin.

John L. Peterson recently joined the sales force of Electro Metallurgical Co., Division of Union Carbide & Carbon Corp., New York, with headquarters in the Pittsburgh office. A graduate of Lehigh University, he was formerly associated with Crucible Steel Co.

Edwin J. Worth has been appointed sales engineer for foundry facing materials and valve bag packers, Black Products Co., Chicago, with headquarters at the Fontana, Calif., plant, which services the western states.

Michael E. O'Byrne, controller, Pacific Car & Foundry Co., Renton, Wash., was recently elected to membership in the Controllers Institute of America, New York.

Robert R. Stough has joined Precision Metalsmiths Inc., Cleveland, as sales engineer in northeastern Ohio. A graduate of Western Reserve Uni-

MILLING NIPPLE THREADS

AS PARTNERS IN
YOUR PROGRESS . . .

OUR FINE MACHINING – is a *plus* factor!

Finishing operations on GLC electrodes, anodes and mold stock are performed with the utmost precision. A strict system of gaging and inspection is required at this stage.

The craftsmanlike spirit of our milling, machining and inspection personnel is a distinctive *plus factor* in the efficiency of GLC carbon and graphite products.

The high degree of integration between discoveries in our research laboratories, refinements in processing raw materials, and improved manufacturing techniques is further assurance of excellent product performance.

ELECTRODE
GLC®
DIVISION

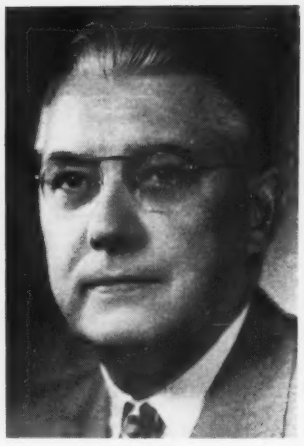
Great Lakes Carbon Corporation

GRAPHITE ELECTRODES, ANODES, MOLDS and SPECIALTIES

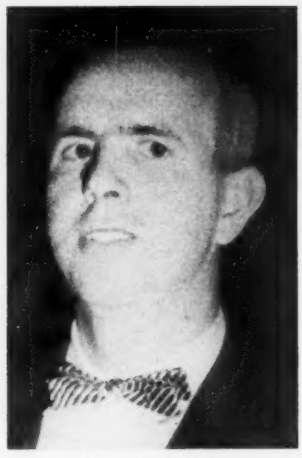
ADMINISTRATIVE OFFICE: 18 East 48th Street, New York 17, N. Y. PLANTS: Niagara Falls, N. Y., Morganton, N. C. OTHER OFFICES: Niagara Falls, N. Y., Oak Park, Ill., Pittsburgh, Pa. SALES AGENTS: J. B. Hayes Company, Birmingham, Ala., George O. O'Hara, Wilmington, Cal. SALES AGENTS IN OTHER COUNTRIES: Great Northern Carbon & Chemical Co., Ltd., Montreal, Canada; Great Eastern Carbon & Chemical Co., Inc., Chiyoda-Ku, Tokyo, Japan

RONALD JENKINS
. . . assistant advertising mgr.

G. W. BOWMAN
. . . division sales mgr.



F. A. LIEBICH
. . . becomes district mgr.



JOHN O'MEARA
. . . heads St. Louis Chapter

versity, his experience covers research on chemical and heat transfer problems, inspection, and production and quality control.

Ronald Jenkins has been appointed assistant advertising manager, Simplicity Engineering Co., Durand, Mich., where he will be responsible for co-ordination of advertising and sales promotion for the company's line of equipment. He is a graduate of Michigan State University.

William B. Hood and **John H. Eichert** have been named assistant hoist sales managers, Yale Materials Handling Division, Yale & Towne Mfg. Co., Philadelphia. Both men are graduates of University of Pennsylvania and have been associated with the design, sale and manufacture of Yale hoisting equipment for more than 5 years. **William S. Woodward,** formerly hoist sales representative for the division in the Chicago area, was named district sales manager of hoisting equipment for the New York state territory, with headquarters in Syracuse. He joined the Yale sales organization more than 9 years ago. **Fred E. Rau,** formerly assistant sales manager of the division's hoisting equipment, was named manager of hoisting equipment sales, succeeding **Carl O. Hedner,** who has been named assistant general sales manager of the Materials Handling Division. Mr. Rau joined Yale in 1948.

Arthur P. Figg was appointed assistant works manager, Lynchburg Foundry Co., Lynchburg, Va. Other appointments at the Lynchburg plant include **Harry Layne,** assistant general foundry superintendent, and **Davis P. Ballowe,** production control manager. **Thurman J. Coleman** was appointed assistant works manager at the company's plant in Radford, Va.

G. W. Bowman was named sales manager of the Hoist Division, Harnischfeger Corp., Milwaukee, to supervise national sales of the company's line of electric and chain hoists and jib cranes. A graduate of University of Detroit, he joined the company in 1939. **F. A. Liebich** has succeeded Mr. Bowman as district manager of the Industrial Division of the Cleveland office. Mr. Liebich was graduated from Ohio State University and has been with Harnischfeger since 1924. He was formerly in charge of the company's Canadian operations.

Walter F. Perkins has retired as vice president-general manager, Metal Products Division, Koppers Co., Baltimore. He was president of Bartlett-Hayward Co., Baltimore, when Koppers acquired it in 1936 and established the Metal Products Division. **E. R. Hall,** vice president and assistant general manager of the division, succeeds Mr. Perkins. **H. B. Cummings,** for the past year assistant vice president and assistant manager of the company's marketing department, succeeds Mr. Hall. Mr. Cummings has been with Koppers since 1945.

H. R. Godfrey Jr., since 1951 specialist in the chemical and petroleum section of the New York office, Allis-Chalmers Mfg. Co., Milwaukee, was made assistant to the general manager of the General Products Division. A graduate of Oregon State College, he joined the company in 1948. **Lewis E. Hammonds** was appointed sales representative for the company in the Cincinnati district. He attended University of Kentucky. **Ralph J. Nicolazzo,** a graduate of Marquette University, was named sales representative in the Milwaukee district.

John O'Meara, elected chairman of the St. Louis Chapter of the AFS for 1956-57, is works manager, Banner Iron Works, St. Louis. Mr. O'Meara was graduated from Carnegie Institute of Technology and spent 3 years with American Brake Shoe Co. at its American Manganese Steel Division, St. Louis, and Electro Alloys Division, Elyria, O. In 1952 he joined Banner Iron Works as plant engineer and became works manager a year later. He was vice chairman of the St. Louis Chapter last year.

Harold A. Muttach, divisional superintendent of coke ovens, blast furnaces, open hearths and foundry, Granite City Steel Co., Granite City, Ill., has assumed the additional duties of assistant to the vice president in charge of operations. He has been associated with the company since 1924. **Frank J. Burgert** has been named assistant to Mr. Muttach.

Joseph P. McGuire, formerly in the sales division of the New York office, Climax Molybdenum Co., has been appointed midwest sales representative for the company, with headquarters in Chicago. He is a graduate of Polytechnic Institute of Brooklyn.

John S. Tiedemann has joined Minneapolis Electric Steel Castings Co., Minneapolis, as assistant superintendent. Following graduation from University of Minnesota in 1951 he was associated with Minneapolis Moline Co., Minneapolis.

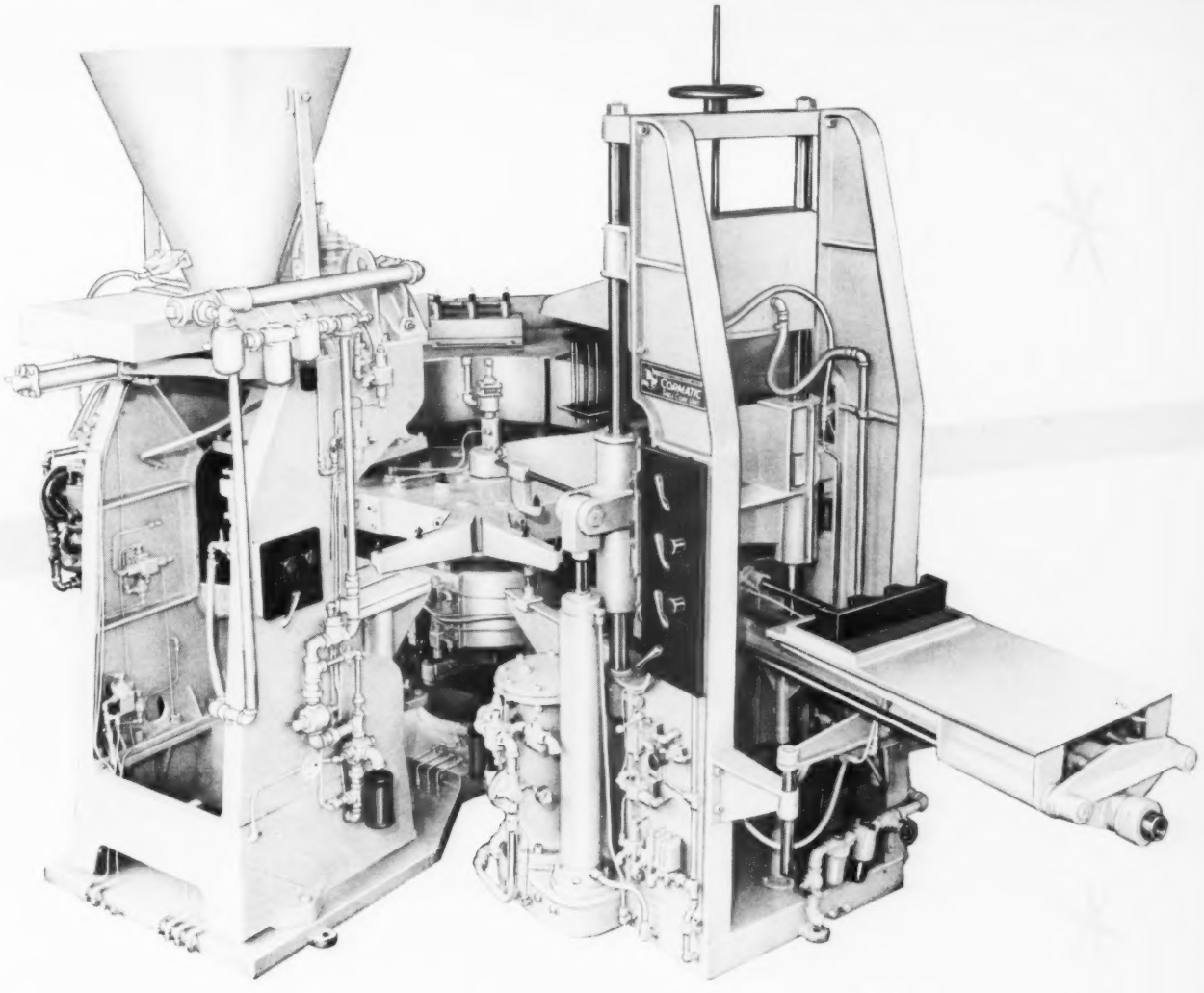
Myron L. Chase, formerly a vice president, Luntz Iron & Steel Co., Canton, O., recently joined the New York office of Luria Bros. & Co., Philadelphia. He is a first vice president of the American Institute of Scrap Iron and Steel.

Circle 612 on Inquiry Card—Page 201→

NOW!

The First Complete Shell

Core Blowing Production Unit



THE NEW CORMATIC SHELL CORE UNIT

Now the new Cormatic provides foundrymen with the first complete shell core blowing production unit. It's the most advanced unit of its type with full provision for complete automatic control of all phases of shell core making. Yet it incorporates foundry-proved practicability and simplicity with all-pneumatic operation and ruggedest construction. There are no electrical relays or circuits.

Production is up to 300 complete cycles per hour. With multiple core box equipment, 600, 900, 1200 or more shell cores can be produced each hour. Check the features of this new unit and then write for full information to *Beardsley & Piper, Division Pettibone Mulliken Corporation, 2424 North Cicero Avenue, Chicago 39, Illinois.*

It's all pneumatic, no electrical relays or circuits

Handles five core boxes in a high production cycle

Complete automatic control for every operation in the cycle

Top production with no chance of error

FOREMOST
BEARDSLEY & PIPER
IN SHELL PROCESSING MACHINERY

MEMBER FEMA

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FOUNDRY MACHINERY

CHICAGO HARDWARE LEADS THE WAY!

with the shell machine that stole the show at Atlantic City!

A jobbing foundry installation of a **FORMATIC** production shell molding unit

Flexibility is the best word for the new Formatic shell molding units, for they are equally at home in production or jobbing foundries. These advanced units handle three different patterns simultaneously at production rates of up to 120 complete full size 24"x 30" shells per hour. If the pattern size is divided, 240 shells may be produced hourly; and if each pattern is divided into four 12"x 15" patterns, up to 480 shells are produced hourly.

Production foundries and jobbing foundries alike find that the Formatic is the best buy in the shell molding field. Check the exclusive features and then send for full information: *Beardsley & Piper, Division Pettibone Mulliken Corporation, 2424 North Cicero Avenue, Chicago 39, Illinois.*

FLEXIBILITY – Independent pattern mounting—pattern and heater plate are mounted as a unit, permitting quick, easy pattern changes.

VERSATILITY – Handles three different patterns simultaneously with individual controls for each pattern.

CONTROL – Pattern temperature, pattern investment and furnace cure are controlled individually for each pattern.

PRODUCTIVITY – Up to 120 24"x30" or 480 12"x 15" shells per hour.

UNIFORMITY – Exclusive Formatic investment station design – the most uniform shells produced on any unit.

COMPACTNESS – No unit with anywhere near the production installed in so small an area.

FOREMOST
BEARDSLEY & PIPER
IN SHELL PROCESSING MACHINERY

MEMBER FEMA

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FOUNDRY MACHINERY

By F. KENNETH IVERSON
Chief Metallurgist
Cannon-Muskegon Corp.
Muskegon, Mich.

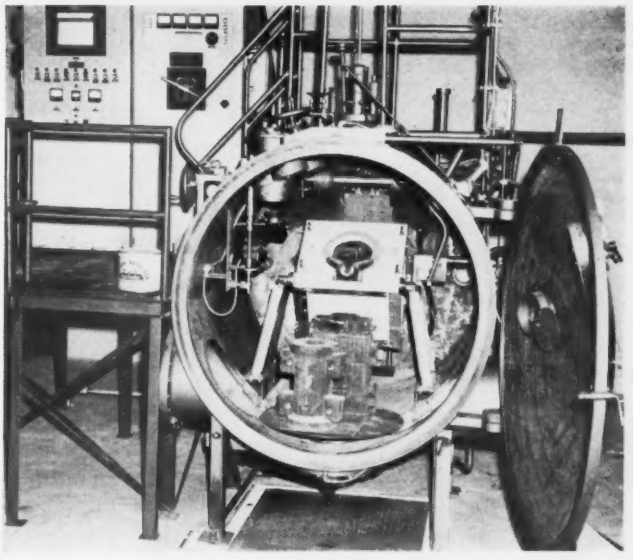


Fig. 1 (above) — Inside view of Cannon-Muskegon vacuum furnace

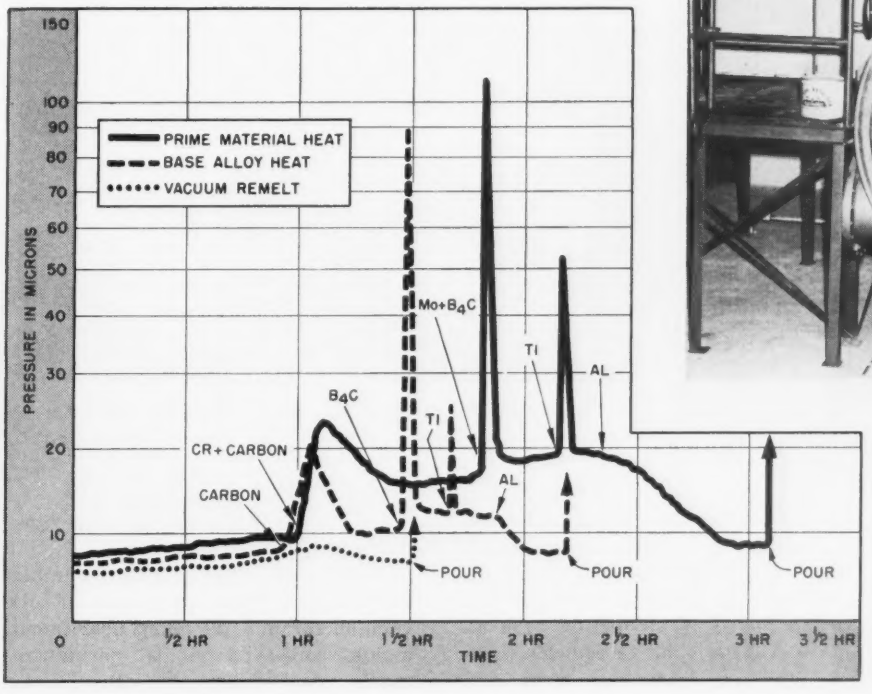


Fig. 2 (left)—A comparison of melting time and pressures for vacuum heats of prime materials, base alloys and vacuum remelt

Investment Casting of VACUUM ALLOYS

BECAUSE vacuum-melted high-temperature alloys definitely have proved their superiority, major consumers of high-temperature investment castings are replacing present cast materials with vacuum-melted wrought alloys. Preliminary tests and the fact that high-temperature cast alloys generally outperform wrought versions of the same alloys give good reason to believe that investment-cast vacuum alloys can give equal or better properties than vacuum wrought materials. At the present time, the investment casting industry is not prepared to take advantage of this opportunity or of coming applications of vacuum melting in other fields.

The investment process is the only major casting method which can be used without basic revisions to produce vacuum castings of iron, nickel and cobalt-base alloys. Several years ago, Cannon-Muskegon Corp. became convinced of the promising future of vacuum alloys in the investment casting field.

The company designed a vacuum furnace for development work in investment casting and for production of remelt alloys. This furnace is shown in Fig. 1. Basically, it consists of a tank, 6 ft in diam and 7 ft long, which contains an induction furnace of 400-lb capacity. The system is powered by a 100-kw, 3000-cycle motor generator set. The vacuum system is designed for pouring nickel, cobalt and iron-base alloys at pressures of less than 10 microns.

This furnace has the accessory equipment necessary to refine and manipulate the charge, including bridge-breaking equipment, an additions mechanism, a vacuum lock additions chamber and provisions for taking temperature readings by immersion thermocouple. A 3-ft diam mold table in front of the furnace is rotated through a vacuum seal. For pouring, molds can be placed on this table and rotated under the furnace in sequence. This turntable is designed with a seal for rotation for centrifugal casting at speeds up to 800 rpm. The tank also contains provisions for preheating and cooling molds under vacuum.

The production of high-temperature alloys in this furnace parallels the procedure used by other vacuum melters, with one important exception: With air-melting equipment, a base alloy suitable for the particular alloy to be vacuum melted is prepared with special deoxidizing procedures. This base alloy is charged into the vacuum furnace; after melting, the heat is deoxidized with carbon. For high-temperature alloys, boron, aluminum and titanium are added as required. This procedure of producing air-melted base alloy has some definite advantages:

1. The air-melted base alloy can be made with a shape factor which best suits the power requirements of the vacuum furnace and has the most desirable packing factor.

2. When the base alloy is made up, raw materials of the highest purity can be used with little regard for their gas content. For example, electrolytic chromium has excellent purity, but has oxygen contents running as high as 0.5 per cent. If charged directly into the vacuum furnace, it causes considerable difficulty. Most of this oxygen can be removed, however, in the preparation of the base alloy.

3. A material of exactly known gas

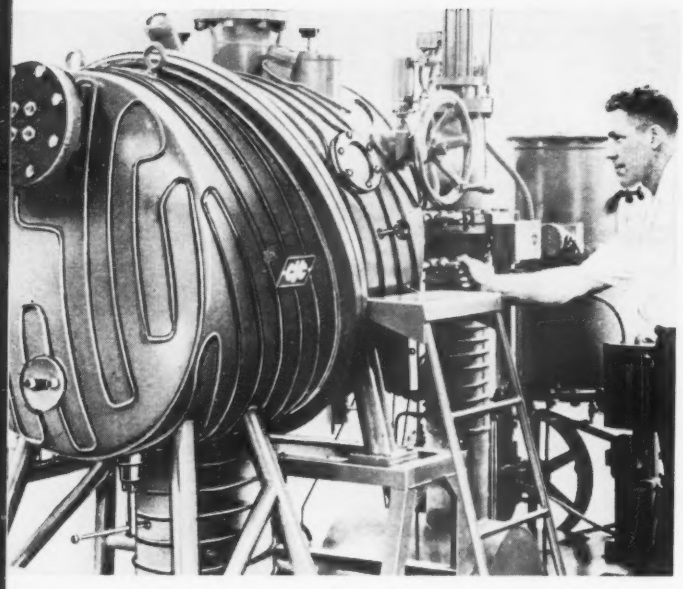


Fig. 3—50-lb vacuum melting furnace for investment casting was produced by Consolidated Vacuum Corp.

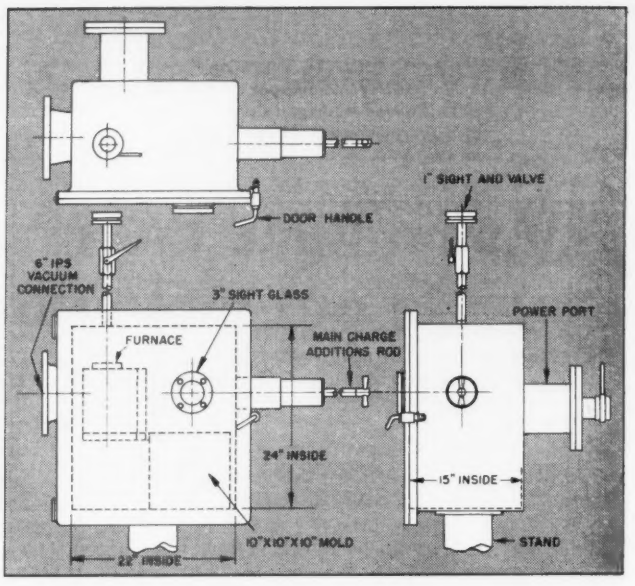


Fig. 4—Drawings of production vacuum furnace for pouring investment castings by vacuum remelting

content is charged into the vacuum furnace. Gas content of different lots of raw materials can vary considerably, but if good procedures are used to prepare base alloys, the gas content of the final material will be at approximately the same level each time, regardless of most variations in gas content of the raw materials. This uniformity provides the vacuum melter with the advantage of starting each heat with an exactly known quantity of gas in the charge.

4. Total gas content of the charge is reduced appreciably by using an air-melted base alloy. Actually, with high-temperature alloys, the base alloy contains less than one-fifth the amount of oxygen which would be present in the chromium alone if electrolytic chromium were used.

Results of these advantages are obvious. Use of air-melted base alloys for vacuum heats reduces melting time and produces a more consistent product.

Fig. 2 is a comparison of melting time and pressures for vacuum heats of prime materials, base alloys and vacuum remelt. It illustrates that use of an air-melted base alloy reduces total heat time by 25 per cent and also allows the heat to be made at lower pressure levels. This chart also shows time savings for a vacuum remelt. The length of time for a vacuum remelt heat is less than half the time required to produce from prime materials.

The company has poured a number of different mold materials in its vacuum furnace, including investment molds, core-sand molds, permanent molds, shell molds and others. At the present time, the investment mold appears to be the most satisfactory method of producing castings of iron, nickel and cobalt-base alloys, although it is not without problems. The most serious problem encountered is the outgassing of the mold during pouring. Even though this action can be quite violent, in most cases there does not appear to be any reaction between the metal and the investment material. Several steps help to reduce this difficulty:

1. Preheating the mold to a fairly high temperature (1800-1900° F) under vacuum reduces the action. This step is accomplished by putting the mold at 1800° F into a preheating chamber, inside the vacuum chamber, before pumping down for a heat. While the charge is being melted, the mold temperature reduces to the temperature of the vacuum preheating chamber.

2. A second method is to place a pouring cup on the investment mold and raise the riser 2 or 3 in. Even if the action is violent, a sufficient amount of metal is retained in the riser to produce a sound casting.

3. Some evidence indicates that substantial improvement is obtained by venting the investment mold so that the gas can escape by other routes than the casting cavity itself. Further work is needed on the type and location of these vents.

The work which has been done

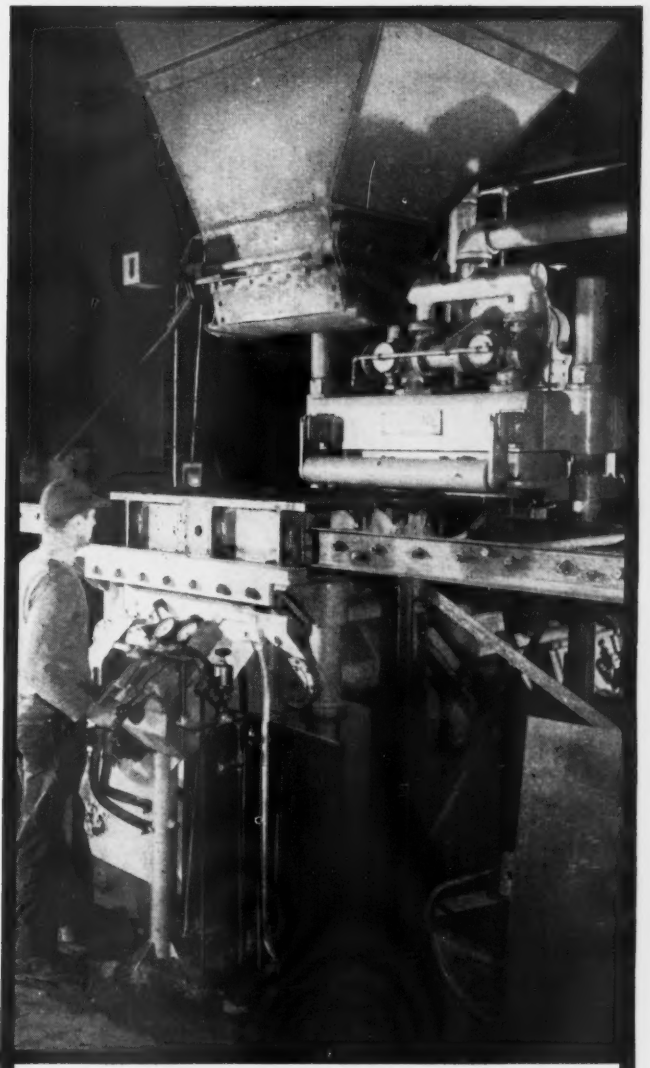
CONDITIONS:

1. 1/2 LB CASTING.
2. 8 CASTINGS PER MOLD.
3. 50% YIELD NOT INCLUDING REJECTS.
4. 30% REJECTS FOR HIGH ALLOY CASTINGS AND 15% REJECTS FOR LOW ALLOY CASTINGS.
5. 30% MARGIN FOR HIGH ALLOY MATERIAL AND 20% MARGIN FOR LOW ALLOY MATERIALS.
6. VACUUM METAL COST - $3.00 PER LB OVER COMPARABLE AIR MELTED ALLOY.
7. FIGURES INCLUDE DEPRECIATION AND OVERHEAD.
8. VACUUM INVESTMENT FURNACE - INITIAL COST $60,000 - CAPABLE OF POURING 10 FLASKS PER HOUR.

ITEM	HIGH ALLOY MATERIAL			LOW ALLOY MATERIAL		
	AIR	ARGON	VACUUM REMELT	AIR	ARGON	VACUUM REMELT
MOLD COST	$35.00	$35.00	$35.00	$28.00	$28.00	$28.00
METAL COST PER MOLD	16.00	40.00	40.00	3.20	27.20	27.20
MELTING COST PER MOLD	2.80	5.20	9.70	2.60	5.20	9.70
CLEANING CUTOFF & INSPECTION	18.00	18.00	18.00	8.00	8.00	8.00
TOTAL COST	71.80	98.20	102.70	41.80	68.40	72.90
MINUS METAL RETURNS	6.24	6.24	6.24	.55	.55	.55
	65.36	91.96	96.46	41.25	67.85	72.35
MARGIN	19.61	27.59	28.94	8.25	13.57	14.47
	84.97	119.55	125.40	49.50	81.42	86.82
SELLING PRICE OF CASTING	$15.17	21.35	22.39	$ 7.28	11.97	12.77
INCREASE IN PRICE OVER AIR MELTING		40.3%	47.7%		64.4%	75.3%

Fig. 5—Comparison of costs of air, argon and vacuum investment casting

TACCONE DIAFORM MOLDING MACHINE



NEW MODELS

FOR FLASKS RANGING FROM

12 x 18 TO 48 x 60

★ **The first completely new method of green sand molding in eighty years.**

★ **Designed for all production rates from full jobbing to full automation.**

★ **Uniform mold hardness assures quality castings of *all metals*.**

Diaform molding with the *Taccone Machine* is the first successful use of the diaphragm method of molding in production and jobbing foundries. It provides squeeze pressure from two to ten times that used by previous molding practice and, therefore, completely eliminates the need for jolting. As a result, maintenance of equipment and patterns is drastically reduced and noise can be virtually eliminated.

The diaphragm "contours" around the pattern to eliminate the need for peen blocks, tucking or hand work. The diaphragm produces high-pressure squeeze in all directions—three times the efficiency obtainable with a flat squeeze board. Full high-pressure molding effects are available with ordinary air pressures.

High speed molding is possible with the *Taccone Molding Machine* because of the absence of moving parts such as jolt and squeeze pistons, an important factor, too, in the reduction of maintenance. Many existing units are on full automation. "Push button" molding guarantees repetitive quality with a minimum of supervision. At the same time, the versatility of the diaform principle provides quality in low production and jobbing castings.

There is no substitute for a uniform mold hardness. It is easy to prove that many of the known casting defects are related directly to lack of uniformity. In addition, mold density is a "must" for casting precision whether the problem is dimension control or simply weight control.

"Precision" green sand castings can be produced only with high-pressure squeeze.

High-pressure squeeze can be obtained most effectively with the Taccone Diaform Molding Machine.

SPEED . . . QUALITY . . . LOW MAINTENANCE . . . VERSATILITY

EASTERN CLAY *products dept.*

INTERNATIONAL MINERALS & CHEMICAL CORPORATION, *20 North Wacker Drive, Chicago 6*

DIXIE BOND • BLACK HILLS BENTONITE • REVIVO BOND • PLASTI-BOND • REVIVO CORE PASTE • CUPOLINOR • CUPOLINE • TACCONE MOLDING MACHINES

Circle 613 on Inquiry Card—Page 201

"This Scale Check Chart showed us how to get Better Cost Control"

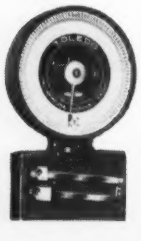
It's New from TOLEDO— send for yours today!

Your scales are a vital element in effective cost and quality control. Errors in weighing go all the way through accounting and affect cost . . . profit . . . or loss! You need to look at *all* your weighing today . . . not as isolated scales, but as a *weighing system.*

Toledo's new Scale Check Chart will show you quickly and accurately how well your scales are serving you, and provide the information you need for truly effective cost control.

This new Check Chart is yours for the asking in a handy kit that contains all you need for an easy, informative appraisal of weighing in your plant. Send for it today. Address Toledo Scale Company, 1408 Telegraph Rd., Toledo 1, Ohio.

On Your Scales . . . Material Becomes Money!



TOLEDO®
HEADQUARTERS FOR SCALES

Circle 614 on Inquiry Card—Page 201

on vacuum investment castings indicates that gating methods which produce satisfactory results under static air pouring produce good castings with vacuum pouring if proper mold materials are used. It also is true that poorly gated molds are not improved by vacuum casting.

Not all dip coats are satisfactory for investment molds that are to be vacuum poured. Some, sodium silicate in particular, give a violent reaction when heated rapidly under vacuum.

Two basic processes can be used for the production of investment castings from vacuum alloys:

1. Remelting vacuum alloys under an inert gas, generally argon.

2. Melting and pouring investment castings under vacuum.

Argon Remelting—Argon remelting consists of having the metal completely surrounded with argon at all times during melting and pouring. This is not as difficult to accomplish as might be supposed. The furnace must be fairly well enclosed, but can be far from airtight. The argon is fed continuously, and a slight pressure of argon is maintained in the chamber.

When the metal has reached pouring temperature, the mold is clamped on an opening and purged a few minutes before pouring. This system has the following advantages:

1. It certainly is the most economical method of producing castings from vacuum alloys. An existing furnace can be modified for argon melting for $400-$500. Complete equipment, including furnace and power supply, does not run more than a few thousand dollars.

2. Without difficulty, production rates approaching those for air melting can be obtained.

3. With high-temperature alloys containing aluminum and titanium, argon remelting provides properties which compare favorably to vacuum-melted properties. For these alloys, the stress rupture life of argon-remelted material is in the range of 80 per cent of the life of the vacuum alloy itself.

There also are disadvantages:

1. A continuous loss of argon results in high melting cost. The exact cost depends, of course, on the size of the chamber, its airtightness and the rate of argon flow.

2. Present results indicate that with many alloys, production argon remelting results in a substantial, if not complete, loss of vacuum-melted properties. With some high temperature alloys which do not contain aluminum and titanium, argon remelting has shown insignificant

Circle 615 on Inquiry Card→

Shell Core Blowing is faster than ever...

with new RESINOX* Cold Coating Resins

SHELL CORES typical of results of blow-molding with Resinox-coated sands. Note clean, sharp edges, intricate detail.

Increased production cycle now possible with improved Monsanto phenolic resins

Now, with new Resinox cold coating resins, an operator can turn out cores completely cured and ready to set in 30 to 60 seconds . . . or less!

Developed in the Monsanto Foundry Research Laboratories, and fully field-tested, these Resinox phenolic resins are fast-curing, free-flowing, non-dusting. They won't cake under normal storage conditions. A small amount of resin gives cores the strength to eliminate rod and wire reinforcing materials. Cores are light in weight and can be stored indefinitely. Most important, the castings have excellent dimensional stability and require little or no machining.

There are many reasons for the fast-growing use of shell core blowing—smoother surfaces, sharper detail, closer tolerances, and quicker curing time with cold coated resins. Send for data sheets and literature on these new Resinox Cold Coating Resins. Write Monsanto Chemical Company, Plastics Division, Room 451, Springfield 2, Mass.

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*RESINOX: REG. U. S. PAT. OFF.

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Hallmark of Quality
"Sterling-Silvery" 10 pound Jisco Pigmies enable you to charge 6% to 13% silicon quickly and correctly (by count) assuring proper analysis for high strength; easy to machine castings.
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Established 1890

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improvement over the properties of good air-melted materials.

3. It is difficult to control the quality of the argon melt. How does the operator know when the argon blanket is poor? He doesn't. In vacuum melting, gages determine the pressure level and, provided they are accurate, the operator knows the condition of his melt. With argon remelting, the only evaluation of the condition of the melt is the performance of the casting. The only method of control which seems feasible would be to have a mass spectrometer reading gas conditions inside the furnace. Even if several furnaces were monitored by the same mass spectrometer, the increase in cost would be substantial.

Vacuum Investment Casting—Investment castings can be produced under vacuum by starting with an air-melted base alloy or prime raw materials; melting, bridge-breaking, deoxidizing, making the necessary alloy additions, and then pouring the investment mold. For production use, this procedure requires a high capital investment in an elaborate furnace with bridge-breaking equipment, mold heating facilities, additions mechanisms and the other gadgetry associated with the complete melting and refining of a vacuum alloy.

Investment castings also can be produced economically and efficiently by remelting vacuum alloys. No additions are necessary. The alloy merely is remelted under vacuum conditions and poured into the investment mold.

Both vacuum systems have an obvious advantage over argon remelting in that they can be used with all vacuum-melted alloys and yield full advantage of vacuum-melted properties. The vacuum remelting process has several additional advantages:

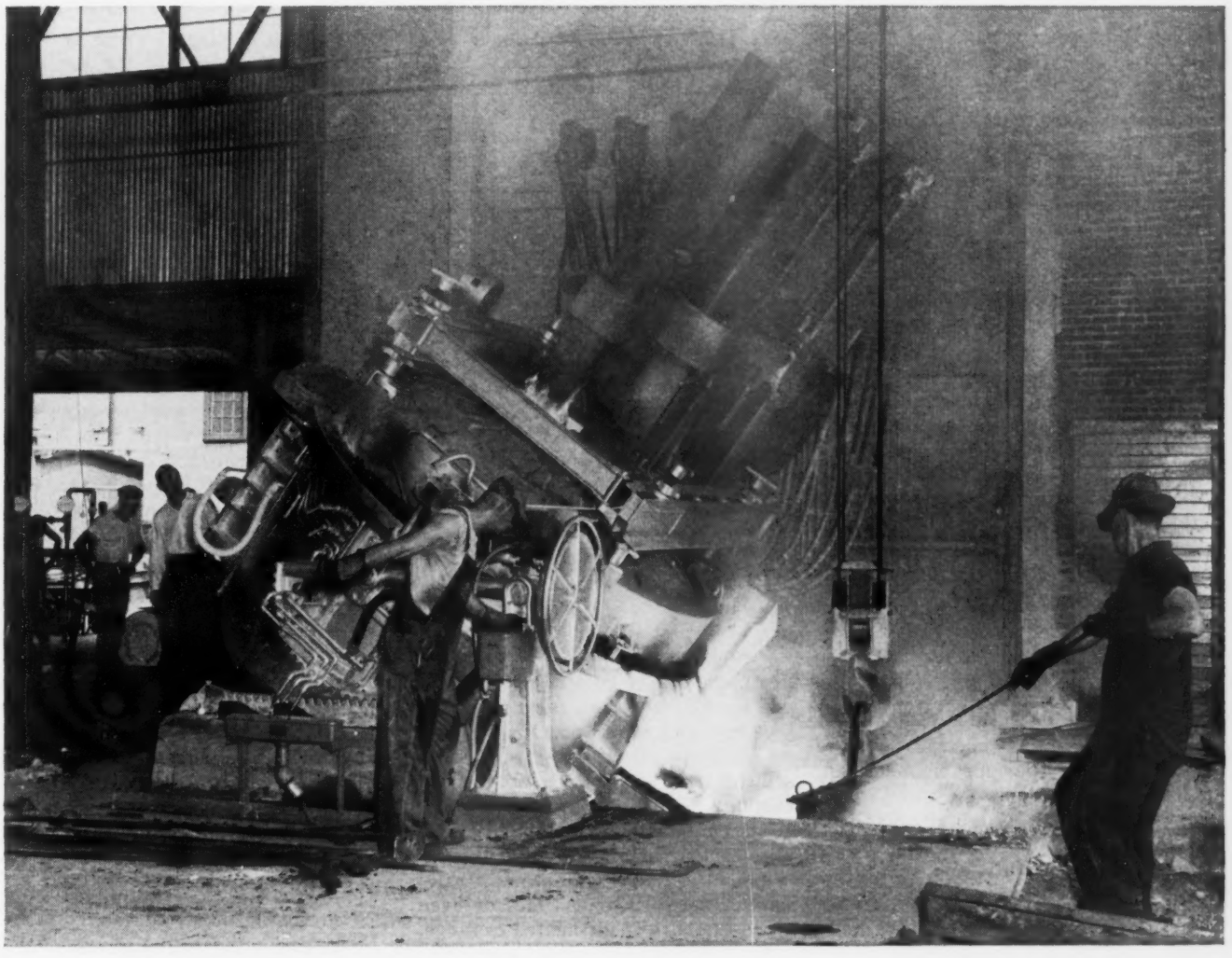
1. As shown in Fig. 2, a vacuum heat made from prime materials requires twice the melting time required for vacuum remelting. With the remelting process, the vacuum equipment operates at twice the efficiency and produces twice as many castings.

2. It is possible to design a furnace specifically for investment casting by vacuum remelting. Such a furnace would have a cost far below the price of the complete vacuum processing unit.

Fig. 3 shows a 50-lb vacuum melting furnace produced by Consolidated Vacuum Corp. for investment casting. This furnace is designed for development and semiproduction. Chamber pressure can be reduced to less than 10 microns in three to four minutes. With a 30-kw generator.

"...a wonderful piece of equipment"

says Keokuk Steel Casting Company about their Lectromelt* Furnaces



This CQT Lectromelt Furnace was recently added at their Keokuk, Iowa plant "to take care of our constantly increasing business". They had outgrown the Type Q Lectromelt furnace which they've used for many years.

Keokuk Steel Casting Company is prepared with equipment and experience to produce practically any kind of steel casting. Diversity in size, application and quantity is traditional here.

The accuracy with which metal analyses and temperatures can be controlled in a Lectromelt furnace —the speed with which metal can be prepared— contribute greatly to such success. Catalog 9-B describes Lectromelt furnaces. For a copy, write Lectromelt Furnace Company, 314 32nd Street, Pittsburgh 30, Pennsylvania (a McGraw Electric Company Division).

Manufactured in . . . ENGLAND: Birlec, Ltd., Birmingham . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa . . . JAPAN: Daido Steel Co., Ltd., Nagoya

*REG. T. M. U. S. PAT. OFF

MOORE RAPID

WHEN YOU MELT... *Lectromelt*

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50 lb can be melted in 30 to 40 minutes. The furnace is fully equipped for basic vacuum processing. It includes an additions mechanism, immersion thermocouple and sampling arrangements and provisions for preheating and cooling molds. The vacuum chamber can accommodate two or three investment molds. In production, the furnace can produce six to nine molds per hour, depending on the raw materials used. This furnace sells for approximately $15,000, exclusive of power supply.

Describes Furnace Operation

For the past year, we have been talking with vacuum equipment suppliers in an effort to obtain for the investment caster a furnace specifically suited for the vacuum remelting process. Fig. 4 shows the basic features of a new furnace developed by F. J. Stokes Co., designed around these principles. It operates in the following manner:

1. The charging chamber and the furnace are loaded with separate slugs of vacuum-melted material. A hot investment mold is placed inside the chamber, and the door is closed.

2. The vacuum is turned on, and the pressure in the chamber is reduced rapidly to less than 10 microns.

3. The furnace charge is melted in about three minutes. The melting cycle is controlled either by time and power or by optical temperature readings through a 1-in. sight glass.

4. As soon as the melt is poured, the cold billet slug of vacuum melted material in the charging chamber is placed in the furnace.

5. After a wait of approximately one or two minutes for the investment mold to solidify and the furnace to be cooled to a nonoxidizing temperature by the cold slug, the door is opened, the mold removed and the cycle is complete.

The following features characterize this furnace:

1. It is a rapid pumping, high-powered furnace which uses a vacuum-melted alloy and is capable of pouring 10 x 10 x 10-in. molds at a rate of eight to ten per hour.

2. The 8-lb furnace and the charging chamber accommodate slugs 2½-in. in diam by 6-in. long or 2-in. in diam by 8-in. long. Billet slugs this size are obtainable from vacuum melters.

3. The investment caster's present generating equipment may be applicable to this furnace.

4. Cost of this furnace, except for power supply, is in the range of $5000-8000.

No investment caster should be without a furnace of this type. He owes it to himself and to his company to make this investment in the future of his industry.

Certainly after all this, there are two important questions: What is the final casting to sell for, and what is the future?

Fig. 5 is a cost comparison of air, argon and vacuum investment casting. In order to be conservative, we have based the vacuum portion on equipment currently available, not on the low-cost remelt furnace previously discussed.

Costs vary greatly in the investment casting industry. The figures here are not necessarily representative of the industry as a whole. They do, however, represent the costs of some specific investment casters and can be used as a basis to figure what the increase in price would be with the vacuum or argon-melting processes.

The vacuum melting cost may seem high, but it is a conservative estimate and includes depreciation of the $60,000 investment over a two-year period on a one-shift basis.

The cost comparison is made on the basis of a constant rejection rate, regardless of the method of melting. If the majority of an investment caster's rejections are due to pattern or mold imperfections, they will not be reduced by vacuum melting. Where a high percentage of the rejections are due to the metal itself, there may be a significant improvement. In some cases the saving due to reduced rejection rates may permit the vacuum casting to sell for the same price as the air casting.

The outstanding fact about this cost comparison is that vacuum investment castings will not necessarily sell for three or four times or even twice the cost of air-melted castings.

There are real possibilities for the future:

"Heck, I didn't know neatness counted."

1. The low-cost vacuum remelting furnace certainly will reduce melting cost.

2. The vacuum alloy processer will develop more efficient and economical methods of production with a corresponding decrease in basic alloy price.

3. Programs already have been initiated to determine the value of gates, risers and sprues from vacuum investment castings. There is every reason to believe that the price for vacuum metal returns will be substantially above the air metal returns price.

The day is coming rapidly when vacuum investment castings will sell for less than one-third more than air melted castings.

Summary—1. In the future, vacuum metals will have many applications in which factors limiting the design or operation of equipment are metallurgical. Investment casters are losing present and future business to vacuum-melted wrought materials.

2. Investment-cast vacuum alloys can do as well as or better than vacuum-melted wrought materials can do.

3. Vacuum alloy producers are prepared to help the investment caster with his development problems and to furnish vacuum-melted alloys for reprocessing.

4. The investment caster will be able to produce vacuum investment castings at less than twice the cost of comparable air-melted castings and at equivalent production rates.

5. New equipment is on the way which will have a relatively low cost and rapidly convert vacuum alloys to vacuum investment castings.

Editor's Note: Mr. Iverson's paper was presented at the Investment Casting Institute's spring meeting at Hotel New Yorker, New York, May 10-11.

Drafting Practices Detailed In Free 56-Page Booklet

"Standard and Simplified Drafting Practices," a 56-page booklet, is being offered by the American Machine & Foundry Co. The first section contains a speech on this subject given by Jay H. Bergen, AMF standards administrator, before the American Society for Engineering Education. The remaining 44 pages are devoted to details of AMF standards on drafting room practice and simplified drafting.

A copy of the booklet may be obtained by writing on company letterhead to Public Relations Dept., American Machine & Foundry Co., 261 Madison Ave., New York 16.

FOUNDREZ 7500 is a very finely powdered thermosetting phenolic resin. You will find that it blends easily, gives uniform shell mold structure and strength in economical sand-to-resin ratios.

When you produce shell molds with FOUNDREZ 7500, you reduce curing cycles. This remarkable RCI resin performs satisfactorily at extremely high oven temperatures, lets you turn out more molds per hour.

While FOUNDREZ 7500 works well in almost all applications, it is especially recommended for tough and intricate jobs where the patterns have a deep draw, and where the sand must flow, fill and bake extra well.

FOUNDREZ 7500-4 is very similar to FOUNDREZ 7500 but is faster setting and intended for use in high speed production. It generally gives a more rigid shell mold than FOUNDREZ 7500.

For large and small parts cast with any ferrous or non-ferrous material, shell molding with FOUNDREZ 7500 and 7500-4 is ideal . . . particularly for long production runs. RCI offers technical help. Get complete data by writing for *Technical Bulletin F-3.*

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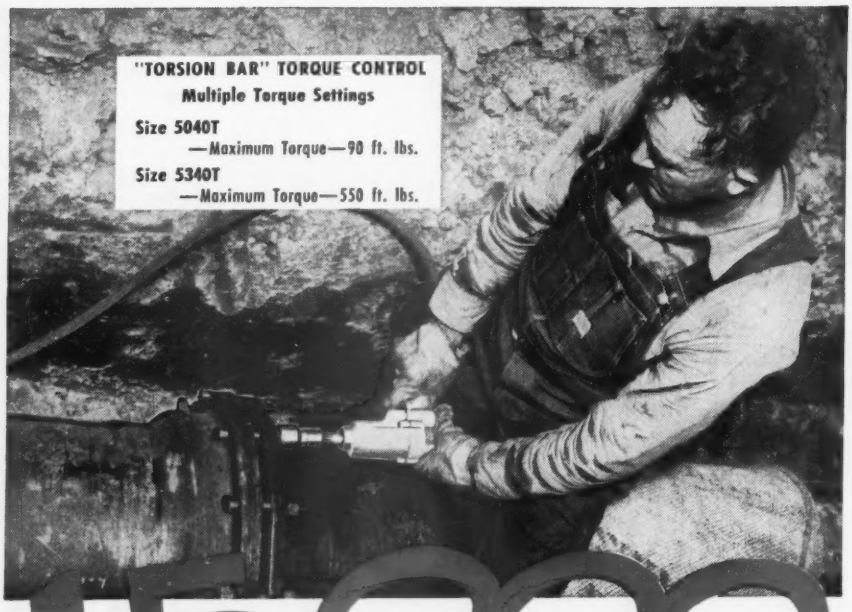

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RESULT:	The Torque Control Impactool automatically shut off at the preset Torque . all guesswork was eliminated . . uniform joint tightness was produced . . . an average of 10 minutes per joint was saved . . . smaller bell holes were required due to compact size of the 5040T . this one tool produced an extra profit of $404.25 on this job.

You can put these new "Torsion Bar" Torque Control Impactools on your nut running jobs and reap these benefits: Positive Torque Control . . . Simple Torque Setting . . . Setting remains constant . . . No pressure regulators needed . . . No operator training.

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Book Reviews

The Control of Quality in Heat-Treatment and Final Operations, cloth, 104 pages, 8⅜ x 11 in., published by the Institute of Metals, 4 Grosvenor Gardens, London S.W.1, England. Price $2.50.

Contains six papers and discussion presented at a symposium held in London in March, 1955 on control of quality of nonferrous wrought metals and alloys.

Papers include "Assessment of Quality of Wrought Products" by W. G. Shilling; "Control of Quality in Heat-Treatment and Final Operations in the Production of Rolled, Extruded and Drawn Aluminium and Aluminium Alloys" by A. J. Field and J. Salter; "Heat-Treatment and Finishing Operations in the Production of Copper and Aluminium Rod and Wire" by H. J. Miller.

Also, "Control of Quality in the Heat-Treatment and Finishing of Copper and Copper-Base Alloys" by V. B. Hysel and T. W. Collier; "Production of Light-Alloy Drop-Forgings, Their Heat-Treatment, Inspection and Testing" by W. T. Edmunds and R. C. Lloyd, and "Heat-Treatment, Inspection and Testing of Wrought Nickel and Nickel Alloys" by W. Betteridge and T. E. Cound.

* * *

High Temperature Technology, edited by I. E. Campbell, 526 pages, published by John Wiley & Sons Inc., New York. Price, $15.

Thirty-five authorities combine efforts in this book to summarize recent developments in the field; also to clarify the research of engineers, metallurgists, ceramists and chemists working to develop new materials of construction for service at very high temperatures. The volume is sponsored by the Electrochemical Society. Editor Campbell is with the Battelle Memorial Institute.

In the first major section of the book, on materials, the authors cover metals, oxides, properties of carbon and graphite at high temperatures, carbides, borides, silicides, nitrides, sulfides and cermets. The second section, on methods, deals with sintering of metallic and nonmetallic refractory materials and with means of achieving high temperature and some of their limitations. The last section is on measurements. It includes data on temperature and its measurement, mechanical and physical properties and special techniques.

* * *

Grundlagen der Metallkunde (Principles of Metallography) by Georg Masing, paper, 153 pages 6 x 9 in., published by Springer-Verlag, Berlin W 35, Germany. Price 12.60 D.M.

This German volume is the fourth edition, improved and expanded. Divided into 12 chapters, it discusses

the following phases: Sphere of metallography; atomic structure of metals and alloys; constitution theories of alloys relating to systems without solid solution and compound formation, compound formation and solid solution formation and limited solubility in the molten state; crystallization procedure; solid state procedure with formation of Fe-C, Zn-Cu and Zn-Al alloys as examples; thermal treatment; plastic deformation; internal stress; recrystallization, and chemical behavior of metals against corrosion mediums.

* * *

Theory and Practice of Lubrication for Engineers, by Prof. Dudley D. Fuller, cloth, 6 x 9 in., 432 pages, published by John Wiley & Sons Inc., New York, and Chapman & Hall Ltd., London. Price, $10.50.

Basic objective of this volume is to present the theory of lubrication to engineers in the most understandable and usable form possible. It attempts to systematize and generalize the basic concepts of the theory to permit the development of an organized course of study for both classroom and individual use. The book demonstrates, through many examples, the wide range of usefulness of lubrication analysis in solving engineering problems.

Prof. Fuller is professor of mechanical engineering at Columbia University, where he teaches and conducts research in lubrication. He also is principal scientist at the Franklin Institute Laboratories for Research and Development and is chief of the friction and lubrication section. In addition, he acts as engineering consultant to various companies.

* * *

Supervisors Safety Manual, 354 pages, published by the National Safety Council, Chicago. Price $3.25 to members, $6.50 to nonmembers.

Designed to provide foremen with a comprehensive guide to all phases of industrial safety, this manual was written by staff engineers of the National Safety Council's industrial department and was reviewed by safety experts from business, industry and government. It can be used as a text for group training or personal study or as a reference work to solve most of the general safety problems encountered by foremen.

The 12 chapters cover these areas: Safety and the Foreman, Know Your Accident Problems, The Human Element, Maintaining Interest in Safety, Instructing for Safety, Health and First Aid, Personal Protective Equipment, Departmental Housekeeping, Material Handling and Storage, Guarding Machines and Equipment, Hand and Portable Power Tools and Fire Prevention and Control.

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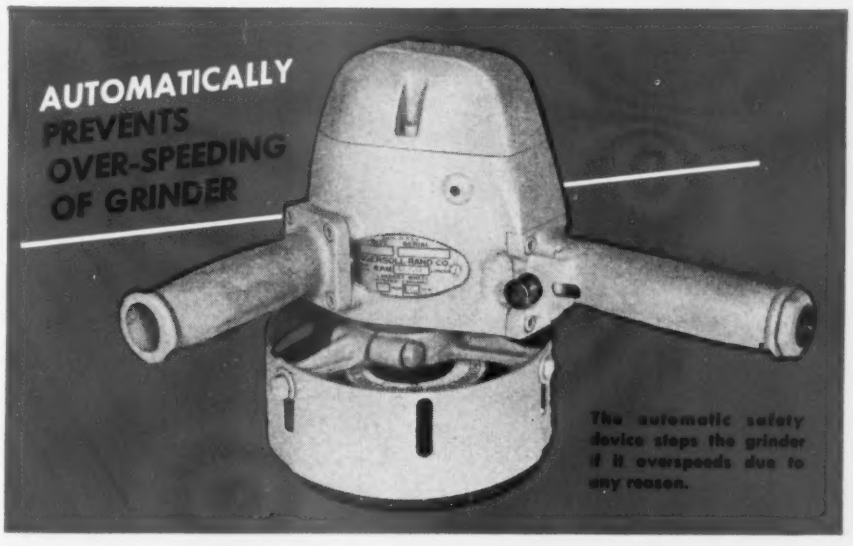
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  Speeds: 3100—4100—4500—and 6000 rpm.

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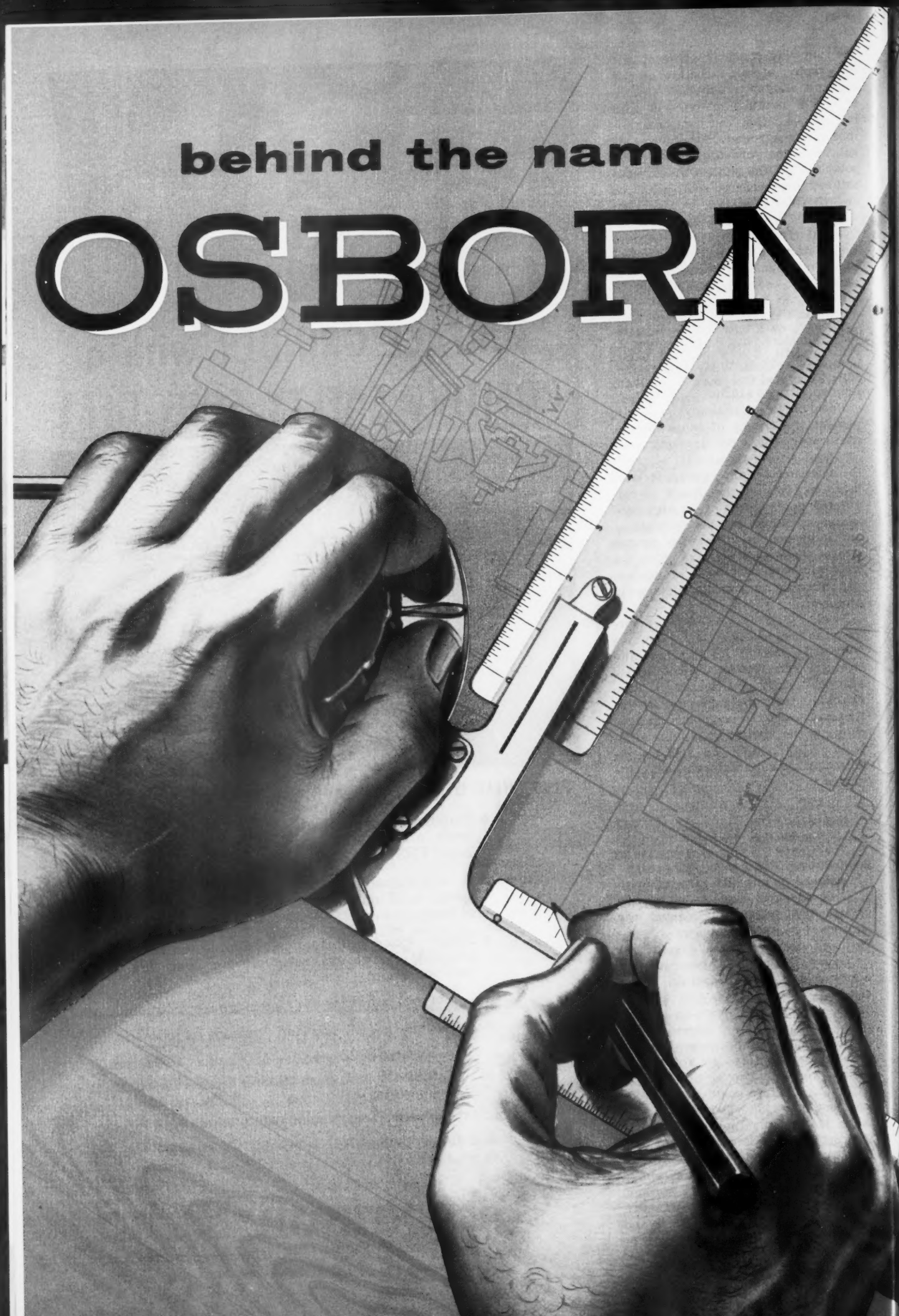
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CORE BLOWERS MOLDING MACHINES
INDUSTRIAL BRUSHES

Directors and society staff members: Seated from left to right: Gardner Van Duyne, Charles E. Brust, Philip C. DeBruyne, Carl L. Liebau, Leon J. Wise, Stowell C. Wasson and James H. Smith. Standing, from left to right: James H. Lansing, (technical and research director), Charles P. Speitel, Anthony J. Haswell, Charles M. Brennan Jr., Richard E. Whinrey, Fred Head (administrative assistant) and Edward T. Price

Malleable Founders' Meeting

Stresses Promotional Activities

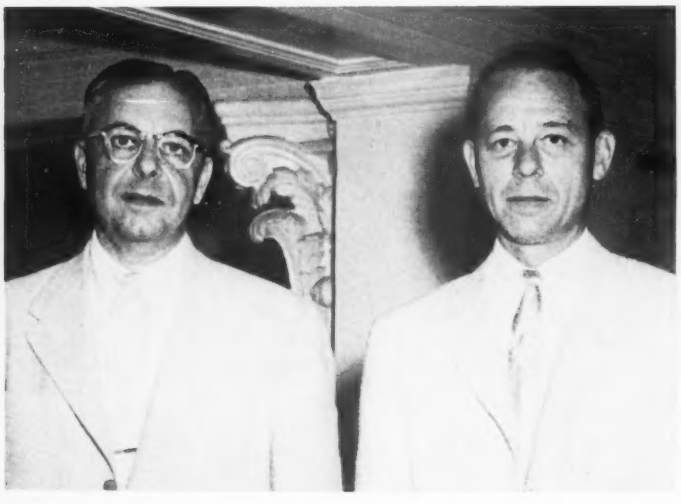
By ROBERT H. HERRMANN
Associate Editor

PROMOTIONAL, research and educational activities, good business practices and the more effective use of the society's services highlighted the reports and discussion at the Malleable Founders' Society annual meeting. It was held June 11-12 at the Homestead, Hot Springs, Va.

In opening the meeting, President Carl L. Liebau, president and treasurer, Federal Malleable Co., West Allis, Wis., commented on the smooth operation of the society and the high level of business during the fiscal year just ended. Continued success and development, he feels, requires increased activity on the part of the society and its members in promoting malleable iron castings.

The work of the society also should be promoted more aggressively to create deeper interest in advantages the society offers its members. Mr. Liebau also pointed to the need for effective work in the field of human relations, society educational work at the precollege level and in encouraging member companies to make more use of information distributed by the society.

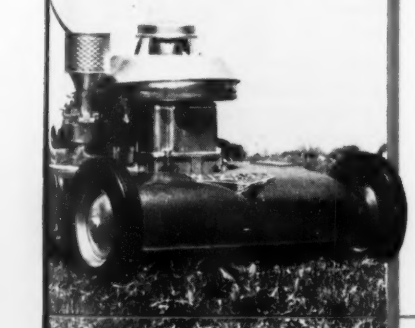
He said, too, that staying in business is becoming increasingly difficult for small foundries. They must



New officers include Leon J. Wise, Chicago Malleable Castings Co., at the left, president, and Philip C. DeBruyne, Moline Malleable Iron Co., vice president

Charles S. Anderson, right, receives the Charles H. McCrea Medal from C. A. Gutenkunst Jr. for "distinguished service to the malleable castings industry"

behind today's modern power mowers



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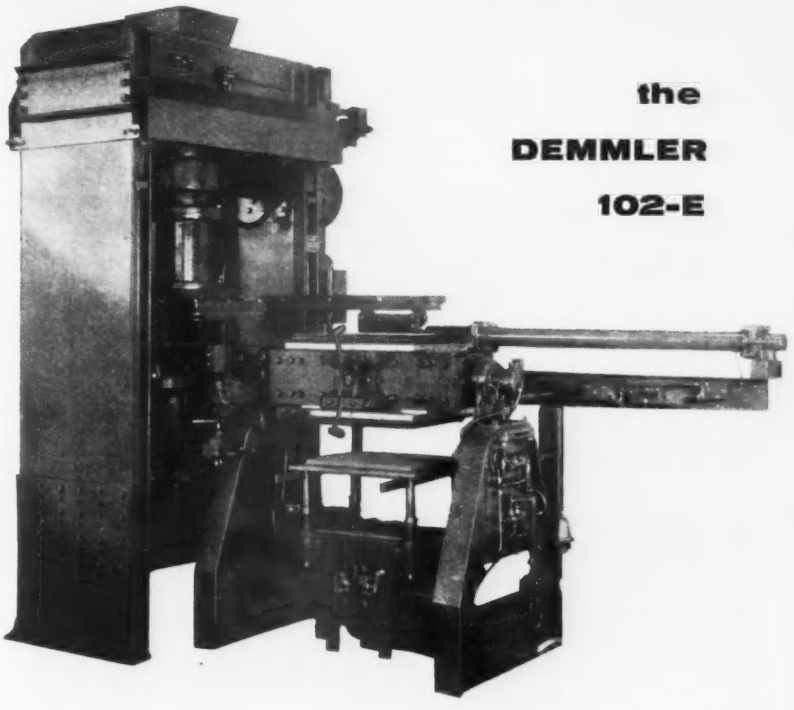

the DEMMLER 102-E

Your foundry will be far ahead in production and dollars ahead in maintenance with a DEMMLER 102-E fully-automatic core blower with stationery sand magazine. It will blow, draw, roll-over and draw cores at a rate up to *300 per hour with only one operator.*

And, during a two-year test period, under actual foundry conditions, the DEMMLER 102-E topped three similar machines for over-all maintenance economy.

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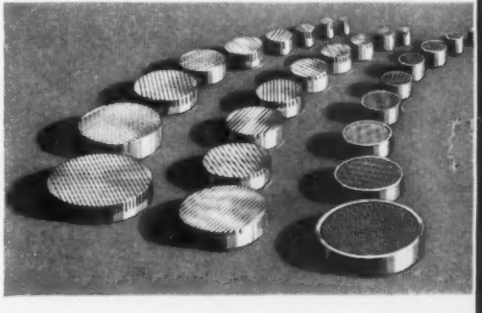

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be kept in profitable operating condition if the free enterprise system is to continue. MFS has a role to play in assisting such foundries to stay alive.

Special Safety Awards—Special awards were given this year to foundries having the best five-year safety records. Grand winner, with an accident frequency record of 2.2, was Central Foundry Division, General Motors Corp., Saginaw, Mich. The division also was the winner in its group (over 400 employees). Other five-year award winners were: Richmond Malleable Castings Co., Richmond, Ind., less than 100 employees: Erie Foundries Division, General Electric Co., Erie, Pa., 100 to 199 employees, and Texas Foundries Inc., Lufkin, Tex., 200 to 399 employees.

New Officers Elected—Leon J. Wise, vice president, Chicago Malleable Castings Co., Chicago, was elected society president. Phillip C. DeBruyne, vice president, Moline Malleable Iron Co., St. Charles, Ill., was named vice president, and Dudley V. Walker, managing director, Eberhard Mfg. Co. Division of Eastern Malleable Iron Co., Cleveland, was re-elected treasurer. Lowell D. Ryan continues his duties under the new title of executive vice president. He also was re-elected society secretary.

New directors include Edward T. Price, general manager, Cadillac Malleable Iron Co., Cadillac, Mich.; Stowell C. Wasson, vice president in charge of operations, National Malleable & Steel Castings Co., Cleveland, and Richard W. Crannell, vice president, Lehigh Inc., Easton, Pa.

Honored for Service—Charles S. Anderson, president, Belle City Malleable Iron Co., Racine, Wis., was presented the Charles H. McCrea medal "for distinguished service to the malleable castings industry." In making the award, C. A. Gutenkunst Jr., president, Milwaukee Malleable & Grey Iron Works, Milwaukee, cited Mr. Anderson's outstanding service over a long period in promoting the welfare of the industry. Mr. Anderson has served on many important society committees and as a director. He was active during World War II and the Korean emergency on industry advisory committees.

Committee Reports—Robert J. LaMarche, vice president and treasurer, American Malleable Castings Co., Marion, O., presented the advertising committee report in the absence of Committee Chairman L. E. Young, sales manager, Superior Steel & Malleable Castings Co., Benton Harbor, Mich. He reviewed the advertisements developed by the society's agency and offered suggestions for improvements in next year's series. The advertisements appear in business publications and have drawn 897 inquiries over a three-year period for information on malleable castings.

Fred Head, MFS administrative assistant, gave the cost committee report in the absence of William H. Caldwell, Northern Malleable Iron Co., St. Paul. Studies into differences in cost estimating procedures led to a recommendation to find ways to improve the method for computing casting weights from blueprints. Prof. John F. Wallace, Case Institute of Technology, Cleveland, prepared a weight estimating procedure. Copies of the procedure have been distributed to member companies.

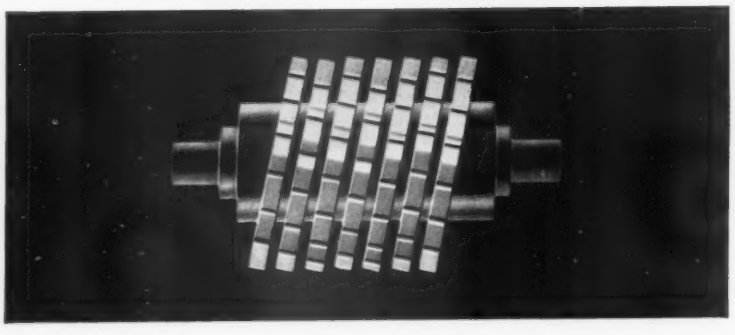
Group accounting meetings based on the theme of methods for making accounting more effective attracted participation on the part of member companies. The committee offers its help on accounting problems to all member companies.

Harvey E. Steinhoff, Wagner Malleable Iron Co., Decatur, Ill., reported that seven chapters of the revised handbook nearly are completed. Anticipated publishing date of the handbook is the fall of 1957.

Two sales engineering clinics, the

ANGLE

for heavy-duty dressing



Desmond's Heavy Duty Dresser makes quick work of truing large, high speed rubber- or resinoid-bonded grinding wheels. Shears and picks at same time with patented angle-set Desmond-Huntington cutters. Dust-shielded ball bearings guarantee lasting precision. Cutters easily replaceable without adjusting bearings. Ask your Desmond distributor how proper dressing can make your grinding wheels serve better—longer.

THE ONLY COMPLETE LINE OF GRINDING WHEEL DRESSERS AND CUTTERS

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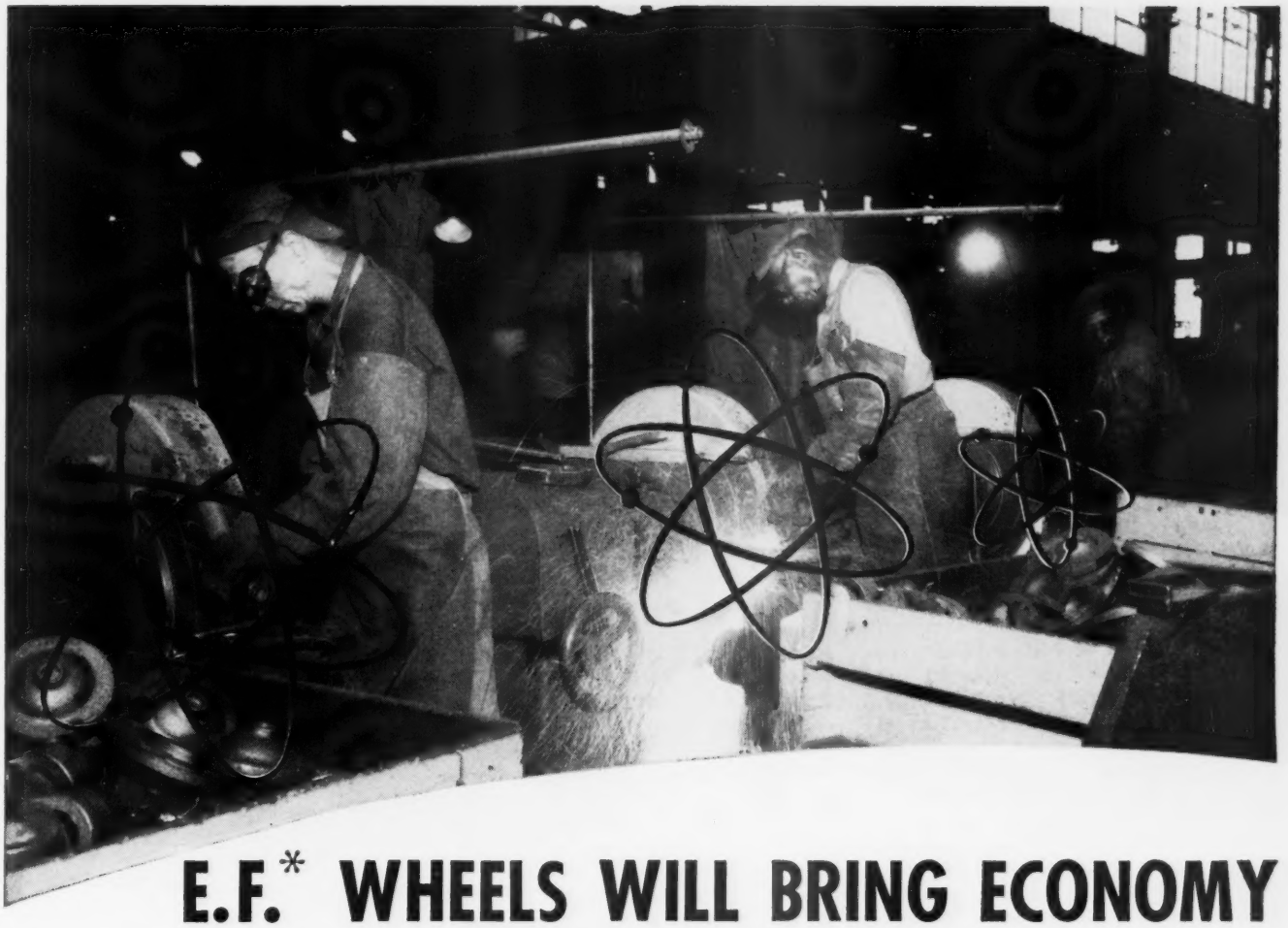

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seventh Market Development Conference and activity in direct research highlighted market development committee work, according to Charles M. Brennan Jr., president, New Haven Malleable Iron Co., New Haven, Conn., who reported for Committee Chairman James W. Hallock, Albion Malleable Iron Co., Albion, Mich. The committee's objective is to probe the size and scope of the future market, to protect the current market and determine the need for future expansion.

Edward T. Price, Cadillac Malleable Iron Co., Cadillac, Mich., personnel and plant operations committee chairman, reported that the society won the National Safety Council award for outstanding reduction in injury frequency rates and for general excellence of its safety program for the malleable industry. Committee work involved studies of wage and personnel practices and the conducting of safety letter contests.

Research and product improvement committee work, as reported by Elmer E. Braun, production manager, Central Foundry Division, General Motors Corp., Saginaw, Mich., involved studies in gating and feeding and issuance of the final report on that work; a basic product study on standard and pearlitic malleable iron, and conducting of the first Technical and Operating Conference dealing with foundry problems and new processes. The recommendation was made that a T & O Conference be held again next year.

William A. Kennedy, supervisor of products, Grinnell Corp., Columbia, Pa., and technical council chairman, thanked those who participated in the gating and feeding project. Cooperative work with the American Society for Testing Materials has led to issuance of a white iron standard sample by the U. S. Bureau of Standards, to the beginning of tests to determine corrosion resistance of standard and pearlitic malleable and to developing an ASTM specification on pearlitic iron bolts and nuts. Other council work has dealt with nodular iron, production of malleable iron in heavy sections, the CO_2 process and other items of current interest to the industry.

James H. Lansing, society technical and research director, reported on welding committee work for Chairman S. E. Kelly, Eberhard Mfg. Co. Division of Eastern Malleable Iron Co. The first phase of the work was to evaluate embrittlement encountered in arc and gas welding of standard and pearlitic malleable iron. Work is being continued on the welding of malleable iron to steel.

In presenting his yearly report, Mr. Lansing stated that study is progressing on the behavior of elements in malleable iron at elevated temperatures. He also listed results of elevated temperature rupture work, which should lead to an ASTM specification for malleable iron use at elevated temperatures. Mr. Lansing also reported that certain low-temperature impact tests had been conducted on notched specimens to determine the service obtainable from standard and pearlitic malleable iron at different temperatures. The results showed excellent malleable behavior at low temperatures and should lead to its expanded use in such service.

Mr. Lansing presented findings discussed in Part V, the final report, on "Gating and Feeding of Malleable Iron." The report summarizes the complete work which involved solidification data, feeder proportions and shapes, gate size and shape, feeding distance and use of chills, pouring rate, pouring temperature, gate location on the feeder, casting taper and application of project results to production castings.

Reports on Society Activities

Mr. Head, in the absence of Mr. Ryan, reported on some of the society's outside activities. A committee of the National Castings Council under chairmanship of Mr. Ryan has prepared a pamphlet on the foundry industry for use by the Business and Defense Services Administration. Copies will be supplied member companies for distribution to school children, plant visitors, employees, school teachers, press representatives and others.

The society was active in opposing continued export of iron and steel scrap and Mr. Ryan testified on that subject before a Senate subcommittee hearing in April. Although Congress voted to continue the export without definite restriction, the Department of Commerce is instructed to survey the amount of potential scrap and submit interim reports and a final report on or before Jan. 31, 1957.

Future Activities—President-elect Wise outlined proposed activities for the coming year. He recommended that records of all research projects be kept for future reference, that the society's publication "Malleable Facts" be issued at regular dates and issued more frequently, possibly six times yearly; that research into the uses of pearlitic malleable iron be expanded; that castings requirements of the gas turbine be studied and that the principles of cost and business accounting be adapted to malleable iron foundries.

He also announced that the eastern section chairman is Charles Brennan Jr. and Dudley V. Walker is western section chairman.

The Central Foundry Division film, "To Meet the Challenge," with recorded commentary by General Man-

GANGWAY! BY J. A. PATTERSON

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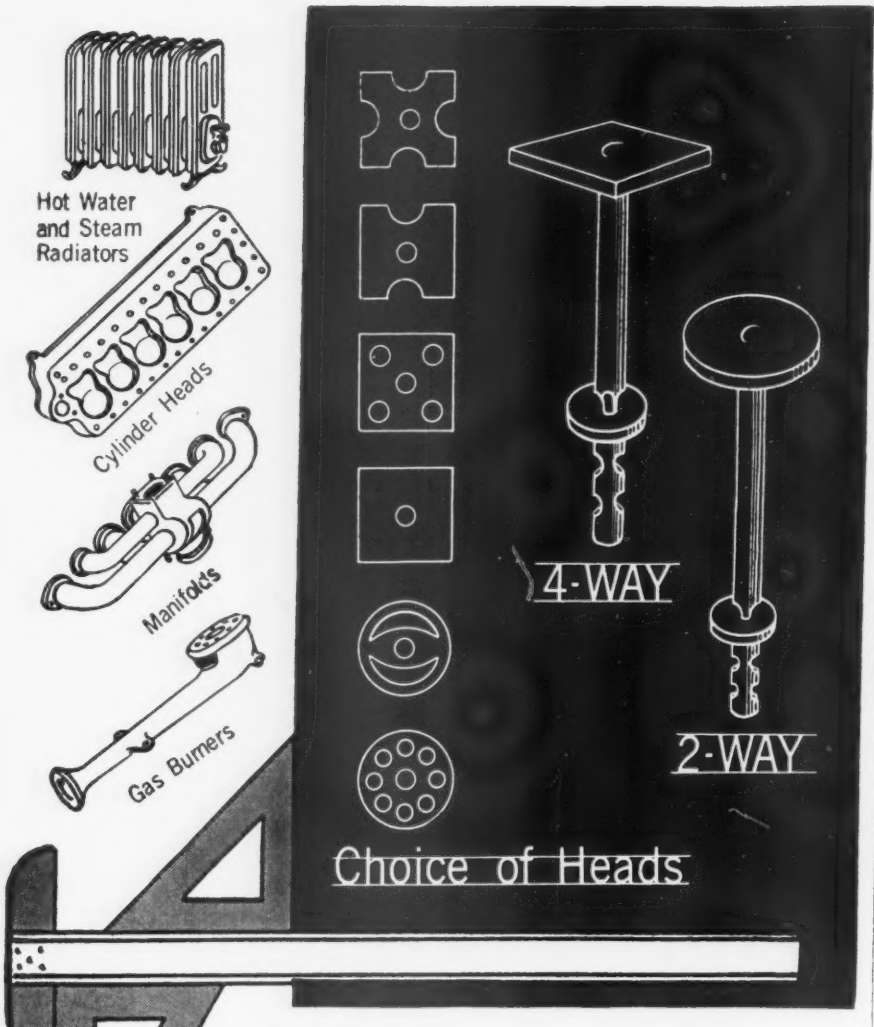

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ager James H. Smith was shown.

The meeting closed with an address by Dr. Ralph E. Lapp, director of nuclear science service, Washington, entitled "The World of Tomorrow." He delved briefly into the history of atom splitting and defined atomic energy as heat created by halves of a split atom hitting other atoms and accelerating them. Atomic heat could be used directly to melt metal.

He spoke of the atomic electrical plants near Pittsburgh and Chicago, saying that 36 elements are byproducts of these plants. In the future ways may be found to segregate some of these elements for use. Developments of the atomic age, some near and some far in the future, include an atomic spectrograph which measures constituents in molten metal, application of one of the element byproducts as a coating on iron to prevent oxidation, radioactive iodine for treatment of thyroid troubles and a method for producing electricity directly from hydrogen atoms removed from sea water without going through the heat process.

Papers Discuss Steel Foundry Dust Control and Ventilation

Eight papers comprise the contents of *Steel Foundry Dust Control and Ventilation,* the proceedings of a conference held last Oct. 13-14 by the British Steel Castings Research Association. The volume contains 98 8x10-in. pages and is paperbound. Copies are available at $7 each from the association, at Broomgrove Lodge, Sheffield 10, England.

Papers presented include the following: "Dust Control on Stand Grinding Machines," by C. M. Stoch; "Dust Control on Swing Frame Grinding Machines," by C. M. Stoch; "Dust Extraction on the Pneumatic Chisel," by J. R. B. Lloyd; "A Low Volume High Velocity Exhaust System," by W. B. Lawrie; "Sampling and Assessment of Airborne Dust," by G. M. Michie; "Efficiency of Dust Collectors," by C. J. Stairmand; "Foundry Ventilation and Heating," by F. R. L. White; and "Dust Control at Foundry Knock-Outs," by W. D. Bamford.

Book Review

Community Relations for Business, by John T. McCarty, loose - leaf, leatherbound, 286 pages, 8½ x 11 in., published by Bureau of National Affairs Inc., 1231 24th St., N. W., Washington 7. Price $12.50.

Operations manual for the business executive contains checklists, exhibits, case histories, sample news releases and suggested programs for

guidance in setting up and operating effective relations programs. Emphasis is on this-is-how-others-have-done-it, this-is-how-you-can-do-it. All material in the manual is from the personal experience of the author, or known by him to be tried-and-proven by other community relations experts.

Nonchemical Method Gives Approximate Iron in Brass

System Measures Magnetic Attraction of Drillings

By Frank J. Versagi

SMALL brass foundries without laboratories and companies with laboratories which are unmanned during second and third shifts will be interested in a rapid, inexpensive method to determine the approximate iron content of brass.

This method has been used successfully by the California Smelting & Refining Co., Los Angeles. For the foundry, its major advantage lies in the fact that it makes possible the prevention of machining difficulties which are encountered when high iron is not detected.

Essentially, the method consists of measuring the magnetic attraction of drillings under carefully controlled conditions.

The drillings are first screened and those particles which pass through a 10-mesh screen are placed on a fibre workplate.

A magnet, similar to an Alnico #5, is suspended at a fixed distance —on the order of 2 in.—from the work plate.

In the experience of California Smelting & Refining Co., there is practically no response when the iron is less than 0.20 per cent.

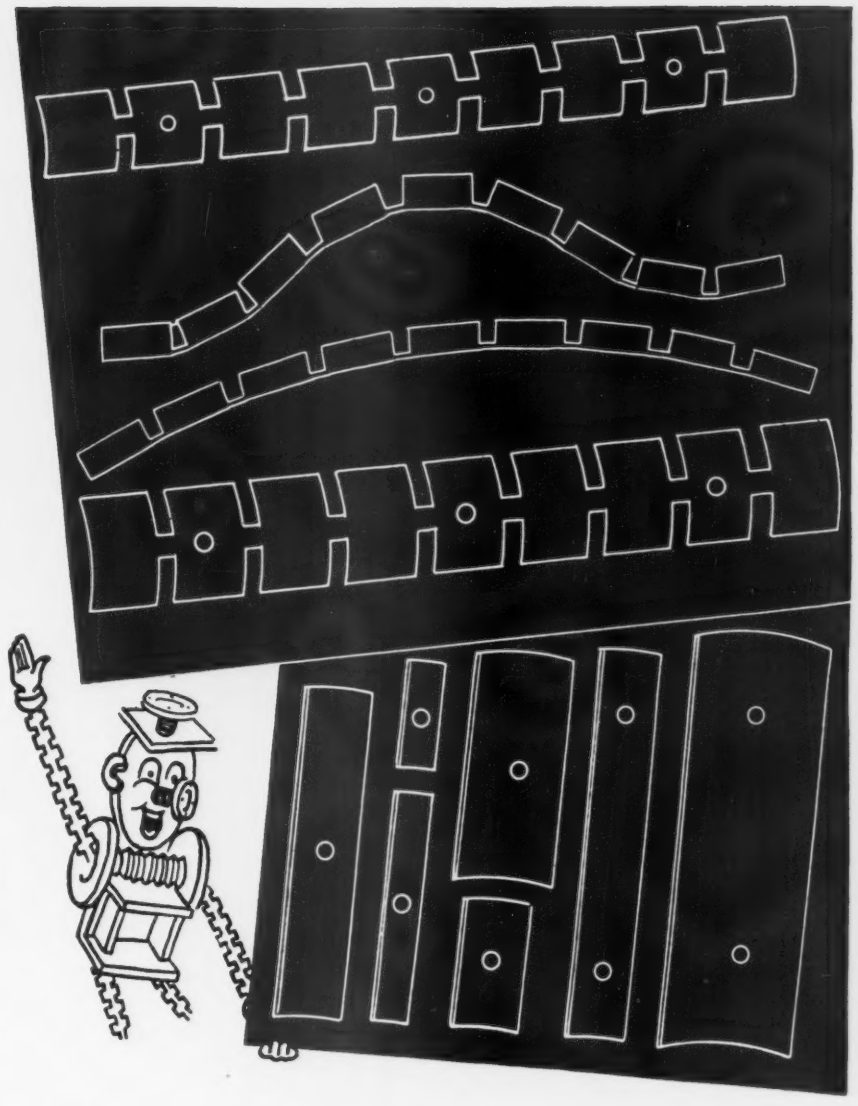
From 0.20 to 0.25 per cent, stirring of the most finely divided particles occurs.

At above 0.25 to 0.35 per cent, the smallest particles actually are attracted to the magnet.

The response of the particles will depend, of course, on the strength of the magnet used and the distance of the magnet from the workplate. California Smelting has arranged a permanent layout with a 12-lb magnetron tube magnet.

Actually, to set up the method, it is necessary only to obtain several brass samples whose iron contents are known, to establish a fixed distance between the magnet used and the fiber plate and to note the reaction of the particles to the magnetic force.

No special training is required, and this method is completely suitable for immediate detection of gross iron contamination in brass.



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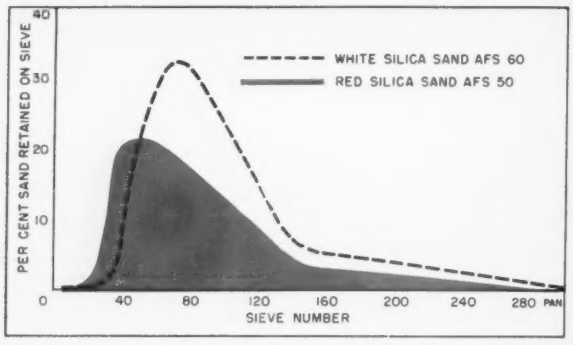

Fig. 1—Chart shows screen analyses of two types of sand used by Kirloskar Bros. Ltd.

Fig. 2—Worker is performing the carbon dioxide gassing operation on a split-case pump corebox

Fig. 3—Illustration shows various types of split-case pump cores produced by CO_2 process

Fig. 4—Molder sets core made by the CO_2 process in split-case pump molds

Fig. 5—Impeller cores on plates are CO_2 hardened through holes in cover

Indian Foundry Uses CO_2 PROCESS to Advantage

By C. A. PHALNIKAR
Chief Metallurgist
Kirloskar Brothers Ltd.
Kirloskarvadi, India

A GREAT deal has been published recently in various foundry journals on the CO_2 process for hardening cores and molds. Many advantages and disadvantages have been cited. Experience with use of the process in the gray iron foundry of Kirloskar Brothers Ltd., Kirloskarvadi, Distt. S., Satara, India, has shown a saving in time and a reduction in defective castings.

Sand Practice—Two grades of local silica sand—white and red colored—are available to Kirloskar Brothers. Screen analyses of these sands are shown in Fig. 1. Both have uniform distribution with round grains. The white silica sand mixture requires more sodium silicate binder, hardens with difficulty and consumes more CO_2. This observation is in agreement with the observations published by Waldemar Schumacher[2, 3]—the finer the sand, the greater the quantity of binder and CO_2 required for hardening. White sand also can be rubbed away with fingers from hardened cores or molds. Red silica sand therefore is used in most of the foundry's work. A mixture of three-quarters red sand and one-quarter white sand also is used for some jobs.

Dry sand with 2½ to 3 per cent seacoal first is mixed in an ordinary mixer for 2-3 minutes. Then ½-per cent red tar and 3½ to 4 per cent sodium silicate is added. Mix-

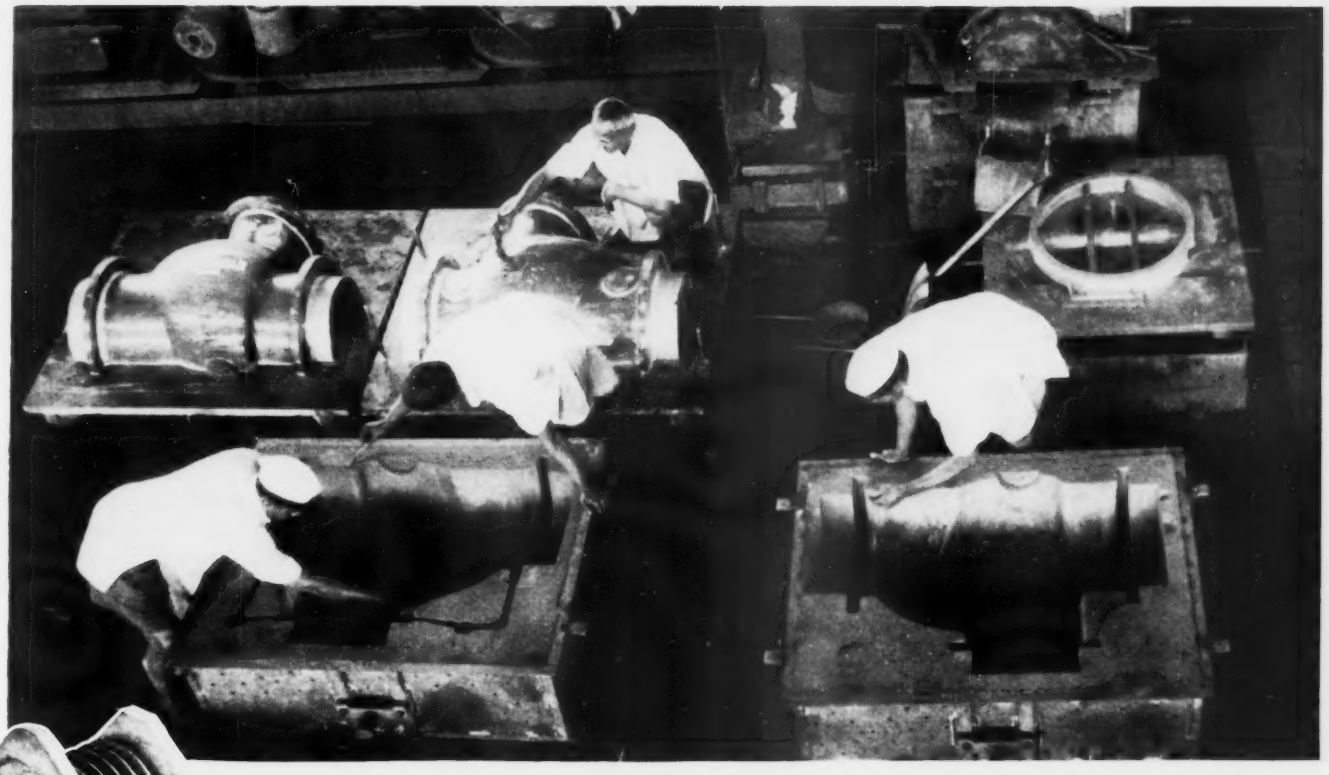

Fig. 6—View shows body pattern for 18-in. reflux valve. With the carbon dioxide hardening process, about 14 man-hours in two days was required to finish the mold

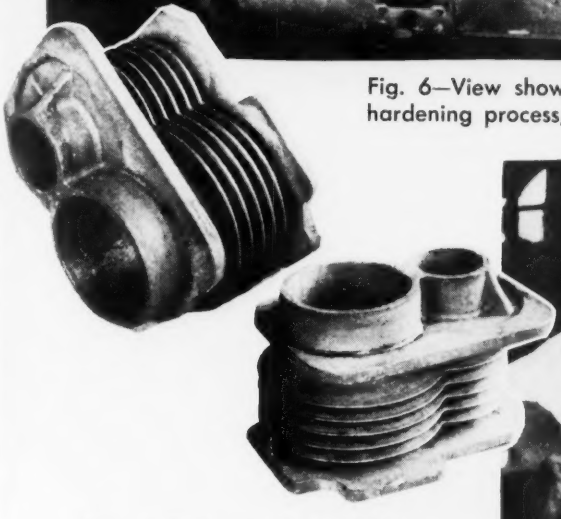

Fig. 7—Scabs caused rejection of many cylinder head castings like these until the CO_2 process was adopted to make molds

Fig. 8—Illustration shows workers as they close mold for the 18-in. reflux valve body. The casting was free of porosity after machining

ing is continued for 2-3 minutes. The red tar addition moistens the sand, reducing the amount of water required. The prepared sand is covered with moist rags for storage.

Making the Cores—The corebox is cleaned, dusted with parting powder and rammed with the sand mix. Excess sand is struck off and ¼-in. holes are made in the core with a vent bar in preparation for gassing. The technique of venting to achieve uniform gassing differs from one corebox to another.

CO_2 at 1200-psi pressure is obtained in cylinders of 40 to 50-lb capacity. The gas is drawn through rubber tubes from the cylinders to small, leakproof cans holding CO_2 at

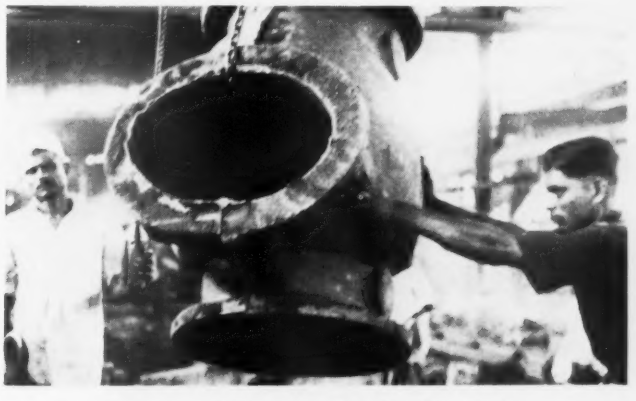

Fig. 9—View of the completed valve body casting, which was made entirely by the CO_2 process

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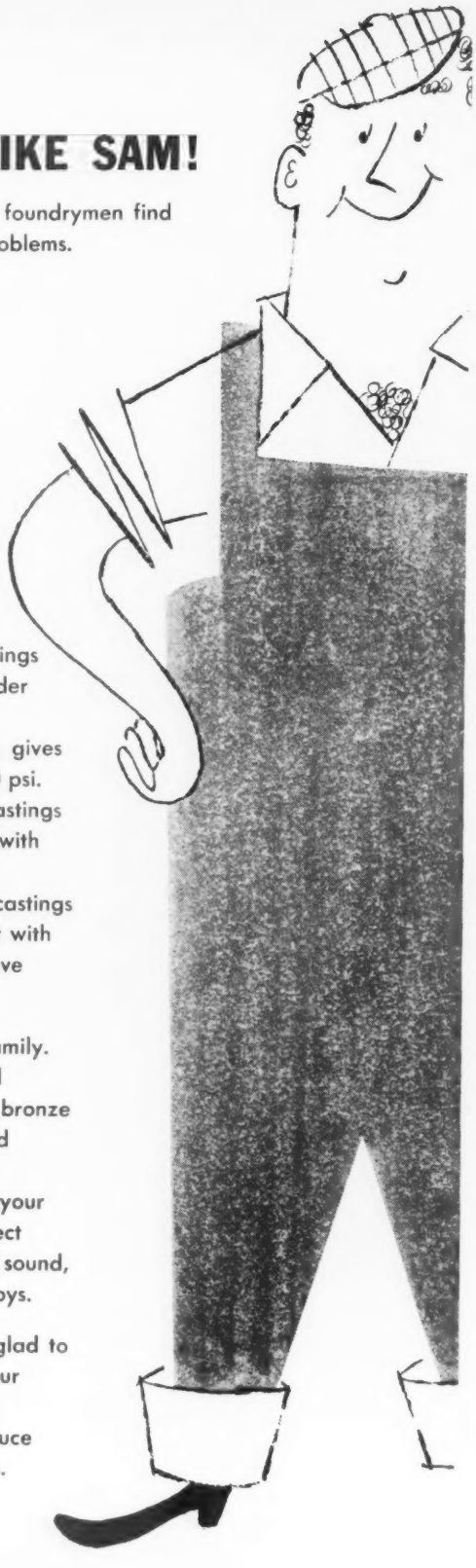

With these engineered bronzes, foundrymen make premium castings with properties that lead to a wider margin of profit. High-strength manganese bronze, for example, gives tensile strength as high as 125,000 psi. Heat-treated aluminum bronze castings have 120,000 psi tensile strength with high yield strength and excellent wear resistance. Silicon bronze castings combine ductility up to 50 percent with high strength. All these alloys have excellent corrosion resistance.

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up to 30-psi pressure. Cores are gassed with a hose attached to a valve on these cans, as shown in Fig. 2. Gassing time is 15-20 seconds per hole. When gas pressure in the cans reaches zero, they are refilled from the main cylinder. It is evident that in this method, CO_2 is not injected at constant pressure as is desired. But the method is simple and satisfactory for hardening cores, although more CO_2 probably is consumed.

The variety of split-case pump cores produced by the CO_2 process is shown in Fig. 3. These cores are made in one piece without reinforcements and jackets. Since the cores are hardened prior to removal from coreboxes, a high degree of dimensional accuracy is obtained, and cores are used in molds immediately after hardening. Setting of cores in the molds is shown in Fig. 4.

Good for Rush Orders—Recently a customer wanted one 18-in. valve delivered in a week. This requirement meant that all necessary castings had to be supplied within two or three days, since allowance had to be made for machining, assembly and testing time. The body casting weighed approximately 1200 lb; other parts were smaller.

Both halves of the body core were made by the CO_2 process to save time. Reinforcing steel strips $\frac{5}{8}$-in. thick, 2 in. wide and 40 in. long were placed crosswise in each half of the corebox. The box was rammed and excess sand struck off. Gassing holes were made by inserting a vent bar from the top surface. After gassing, the corebox was inverted, rapped and removed with a hand crane, leaving the hardened half-core on a bottom board. Excellent stripping was obtained, which saved repair time. Approximately 14 man-hours was required to complete the two halves of the core within two days. The cores were quite hard and were given a coat of plumbago wash by spraying and were air dried. The mold for this job was made with sodium-silicate bonded sand and will be described later.

Impeller Cores Present Problem—If vaned impeller cores are hardened in the corebox, the shape of the vanes obstructs removal of the core from the box. Hence, the green core is removed from the box to a cast iron plate and is enclosed with a jacket and top cover containing holes. When CO_2 is passed through these holes, the jacket and top cover is removed, leaving the hardened core on bottom plate. This method is shown in Fig. 5.

The gassing opeartion could be

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eliminated for the impeller cores. These thin cores will harden overnight in the air or can be hardened quickly in an oven.

Mold Making with CO_2—The method[2, 3] adopted by many foundries to harden molds with CO_2 involves covering the pattern with sodium-silicate bonded sand backed with heap sand. After the pattern has been stripped, the mold is covered with a board and CO_2 is injected directly into the mold cavity. At Kirloskar Brothers the mold is hardened while the pattern is still embedded in the sand by passing CO_2 through holes in the top of the molding flask. Good pattern stripping is obtained without making special taper allowances.

Making the mold for the 18-in. valve body within the limited time allowed presented a problem. Usually heavy molds prepared in the conventional manner are dried completely in an oven. Production time is considerable because of the bigger flask size and the need for gaggers.

Because of the time restriction set up by the customer, the mold was made with the CO_2 process. The wooden pattern was split and the two halves mounted accurately on two different wooden boards, as shown in Fig. 6. The pattern was dusted with parting powder and covered with sodium-silicate bonded sand. About 500 lb of sand per flask was required to cover the pattern. This was followed by filling with heap backing sand, and the flask was rammed by hand. The excess sand was struck off and numerous holes were made with a vent bar in the top surface of the mold, penetrating the depth of the pattern. CO_2 was injected through these holes. From six to eight of the cans holding CO_2 at 30-psi were required per flask.

After the hardening operation, the

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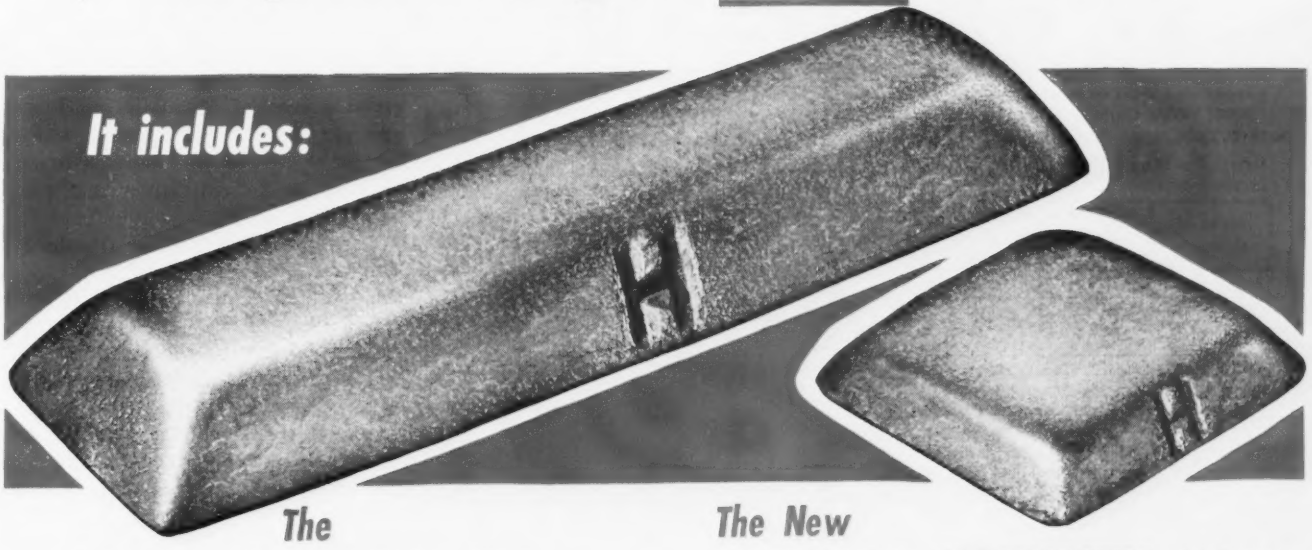

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flask was rolled over and the pattern removed slowly. Excellent stripping of the pattern was obtained, and the mold was hardened uniformly in all areas. Four molders prepared the cope and drag, and about 14 man-hours in two days was required to complete the mold. A plumbago wash was sprayed on the mold and allowed to air dry. On the third day, half of the core was placed in the drag; then the other half was set on top of this. The parting of the core halves was filled with plumbago, and the mold was closed for pouring, as shown in Fig. 8.

The casting was poured from two sides with two ladles in 2 minutes and 38 seconds. On the fourth day, the casting was broken out and the core was removed easily. The casting was cleaned, Fig. 9, and sent to the machine shop on the same day. The casting was free from any porosity after machining. It was assembled and withstood 300-lb testing pressure on the sixth day.

Other Jobs Are Successful—Constant trouble was encountered in making roller cored castings. A variety of core sand mixtures and different kinds of gates and risers were tried without success. Because the main body of the core is covered with metal, core gases were trapped, causing blowholes in the casting. This defect was eliminated by use of a CO_2 core.

With conventional molding methods, production of compressor cylinder head castings, Fig. 7, resulted in many rejects due to scabbing. Invariably, sand in the finned section washed out. The mold was dried completely in an oven, nails were inserted in the finned section for reinforcing purpose, a special linseed oil facing-sand mixture was used, and other corrective measures tried. None produced good results. The problem was solved by making the mold by the CO_2 process.

A recently published article[1] described the advantages of making flat surface castings by the CO_2 process. It is general practice to use a special facing-sand mixture containing a high percentage of seacoal and woodflour for this type of job, in addition to heavy reinforcements in the form of nails. The most common defects encountered are rat-tailing and scabbing.

Kirloskar Brothers now uses the CO_2 process for producing all types of flat surface castings. The molds are prepared without gaggers, are given a coat of plumbago wash and are air dried. Production of such castings is greatly increased with rejects due to rat-tailing and scabbing minimized.

Good Surface Finish Obtained—The use of seacoal and red tar in the sodium silicate sand mixture yields fairly good finish in the case of thin castings. In medium and heavy castings it is essential to coat cores and molds with either plumbago wash or a self-firing compound to obtain good finish. If this care is not observed, sand adheres to the casting, resulting in a rough, whitish surface finish. This is one of the disadvantages of the CO_2 process. In addition, when cores are coated with the wash, their collapsibility is improved.

Acknowledgement

The author expresses his gratitude to Kirloskar Brothers Ltd. for granting permission to conduct experiments and publish the results, to A. K. Phalnikar, works manager, for helpful suggestions and discussions and to S. A. Phalnikar for doing the experimental work.

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1. Dr. D. V. Atterton, "Carbon Dioxide Process," *Foundry Trade Journal*, May 5 and May 12, 1955.
2. Waldemar Schumacher, "How to Bake Cores Without Heat," *Modern Castings*, July 1, 1955.
3. Waldemar Schumacher, "Recent Developments in the CO_2 Process," FOUNDRY, January, 1956.
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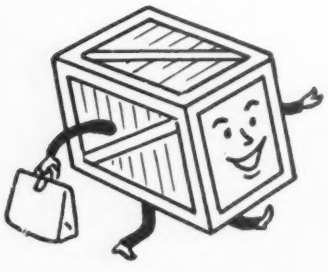

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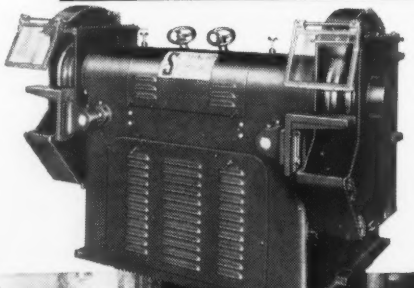

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HALLMARK OF METALWORKING THRUOUGHOUT THE WORLD

Circle 633 on Inquiry Card—Page 201

"People's lives depend on our castings," says Nick Odorisio

"And we depend on Cities Service Core Oil," continues this well-known foundryman at Kimball Brothers Company.

If you operate a foundry, there's a chance you've heard of Nick Odorisio. Now with Kimball Brothers Company of Council Bluffs, Iowa, Nick has devoted the last 45 years to the foundry business, guiding many a mid-west foundry to smoother operation.

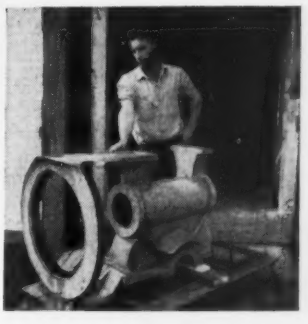
"Here at Kimball Brothers," says Nick, "there's probably less room for error than in almost any other foundry operation . . . for we make freight and passenger elevators ranging up to 30,000 pounds capacity, and people's lives literally hang on the quality of our castings.

"Naturally, that requires perfect cores and perfect core oil . . . and that's why we rely on Cities Service Delco #36. I've been in the foundry business since I was 15 years old and tested a lot of core oil, but Cities Service Delco #36 gives more trouble-free performance than any other oil I've ever seen. The oil is uniform, prevents trouble with gas which could produce flaws, and allows practically no breakage of cores. I'd never hesitate to recommend Delco #36."

For more information about this unique core oil which Mr. Odorisio praises so highly, talk with a Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, 20 North Wacker Drive, Chicago 6, Illinois.

Getting to the Core of the Situation. Kimball Brothers makes cores for elevator castings ranging from a few ounces to 1500 pounds. But there's almost never any breakage or flaws, thanks to Cities Service Delco #36 Core Oil.

Complicated Casting Made Without Complications is displayed by Assistant Foreman Richard Flowers. Like Nick Odorisio, he combines expert knowledge with extreme pride of craftsmanship and Kimball Brothers' castings reflect it.



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QUALITY PETROLEUM PRODUCTS

Industry Briefs

INTERLAKE IRON CORP. stockholders have approved the acquisition of Globe Iron Co., Jackson, O., and Globe Metallurgical Corp., Beverly, O. The transfer will enable Interlake to produce a broad range of silvery pig iron and ferroalloys, in addition to its standard grades of merchant iron.

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., has merged with the Universal Major Elec Appliances Inc., Baltimore, with no change in officers, directors or name of the former. Universal's only manufacturing operation was through Mirawal Corp., Baltimore, producer of porcelainized metal sheeting.

Laclede-Christy Co. Division, H. K. Porter Co., St. Louis, refractories manufacturer, has installed a chemical laboratory to supplement its physical testing facilities and its petrographic laboratories in providing complete data on raw materials and finished products.

Archer-Daniels-Midland Co. has moved its New York sales office from the Woolworth Bldg., to Room 1600, Transportation Bldg., 225 Broadway, New York. Telephone number, Digby 9-0750, is unchanged.

Consolidated Foundries & Mfg. Corp., Chicago, has acquired certain assets of WaiMet Engineering Co., Waban, Mass., which have been merged with facilities of its Michigan-Standard Alloy Casting Co., to form a new division to be known as WaiMet Alloys Co. The new division, with manufacturing, sales and research centralized at 1995 Guoin St., Detroit 7, will specialize in production of master alloys. Roger F. Waindle, as president of WaiMet Engineering Co., is president and general manager of WaiMet Alloys. He is currently on leave as chief, Castings Branch, Iron and Steel Division, Business and Defense Services Administration, Washington.

Bradford Machine Tool Co., Cincinnati, has sold its machine tool and pedestal grinder product lines and part of its manufacturing facilities, to Frank B. Stallings, Cleveland. Equipment has been moved to Lansing, Mich., and a new company, Bradford Machine Tool Co. of Mich., has been formed, which becomes another of Mr. Stallings' Universal affiliates.

Baker-Raulang Co., Cleveland, has opened a factory branch office at 5627 South Harlem Ave., Chicago 38. It will carry a complete stock of parts for the company's industrial trucks. Jack Hiltibrand is manager.

Carborundum Co., Niagara Falls, N. Y., will build an extension to its silicon carbide furnace plant in Vancouver, Wash. Building addition will be of steel construction of the same general design as the present facility. The large furnace plant will be extended 150 ft and will be equipped with an additional battery of electric resistance furnaces and other processing facilities.

Union Carbide & Carbon Corp., New York, plans construction of new facilities on its Westchester property near Tarrytown, N. Y., on a 280-acre site in the towns of Greenburgh and Mount Pleasant. Construction, to start early in 1957, will include an office building, a basic research laboratory, and a service laboratory.

Thor Power Tool Co., Aurora, Ill., has opened a new factory sales and service branch at 606 West Seventeenth St., Kansas City. It will serve Kansas, Oklahoma and parts of Iowa, Missouri, Nebraska and Texas. Manager is E. C. O'Connell, formerly manager of the San Francisco branch.

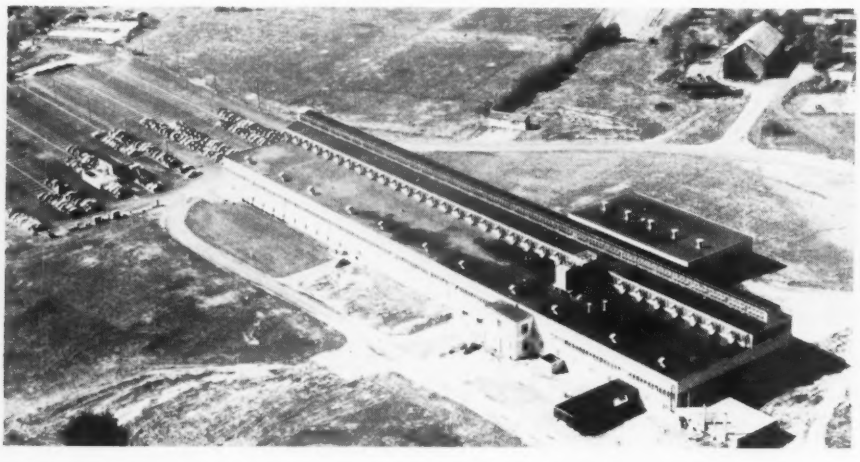
Foote Mineral Co., Philadelphia, plans a $2 million expansion of production facilities at its Electromanganese Division, Knoxville, Tenn. Construction, which affects the Lorraine St., plant, newest of the division's two operating units, will be started immediately and completion is expected in early 1958.

Galt Malleable Iron Co., Galt, Ont., has been purchased by Masters, Smith & Co. Ltd., Toronto. The latter controls publishing and paper products companies. Galt produces malleable iron and nonferrous castings.

Fuller Co., Catasauqua, Pa., has opened a new office at 20 on the Mall, Prairie Village, Kansas City 15, Mo. David W. Armstrong, manager of the Kansas City district, will manage the new office which is a suboffice of the Chicago branch.

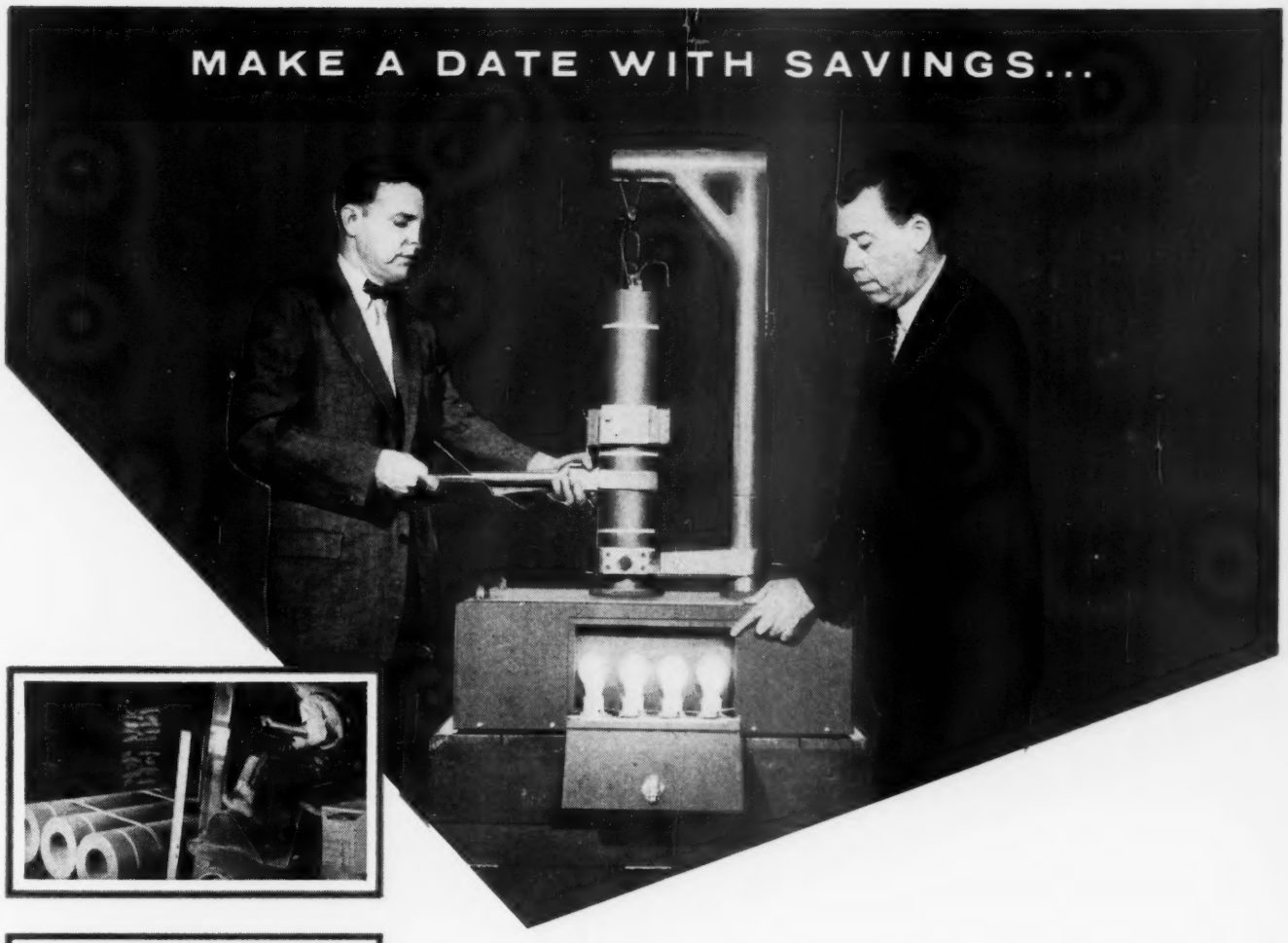
Metal Treating Institute reports May billings by members totaled nearly $3.3 million, 24.5 per cent higher than a year ago. Billings for the first five months were 29.8 per cent larger than in the 1955 period.

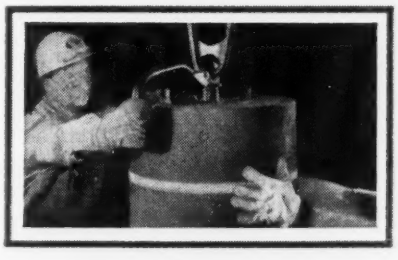
Metallurgical Products Dept. is the new name of the former Carboloy Dept. of General Electric Co., Detroit, where department headquarters will remain. The new name reflects the company's greater emphasis

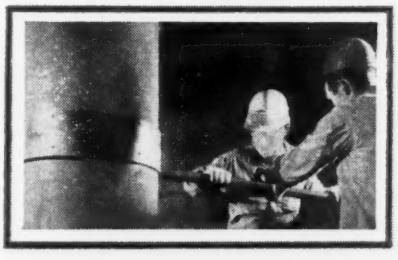


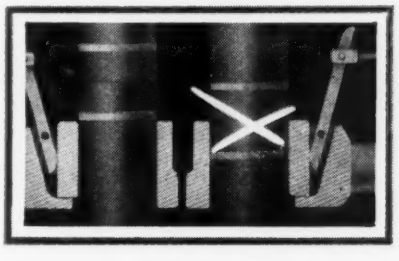
DIE CASTER: This new plant of Doehler-Jarvis Division, National Lead Co., recently went into service. It is located just outside Pottstown, Pa. The two-story, $5-million plant covers 210,000 sq ft, produces aluminum castings

MAKE A DATE WITH SAVINGS...









Arrange for your men to see and hear

National Carbon's

new electrode shop training program

Here's a must for operating, supervisory, purchasing and management personnel . . . any one concerned with the procurement, storage, handling or use of electrodes. It's available free — in your own plant or any other mutually convenient location. Thorough coverage of the manufacturer's recommendations for proper electrode usage . . . illustration and demonstration drive home the fundamentals of good electrode practice . . . help you get top value from every electrode dollar.

- Product quality recognized to be the highest in the industry.
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Write or call right now for complete details of the new electrode training program and arrange to have this important educational demonstration put on for your personnel.

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- MEASURES
- TRANSPORTS
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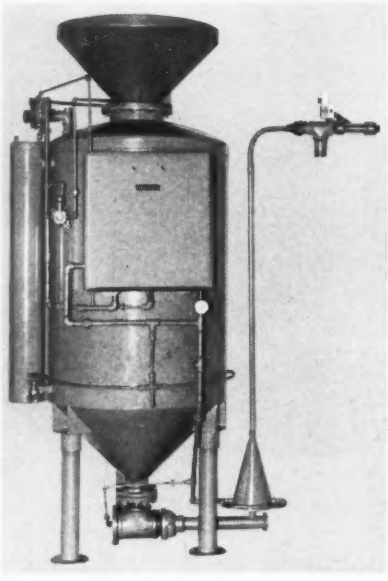
Haylco, the originator of automatic moisture controls for sand systems, invites inquiries on its newest development illustrated here. Hopper sizes start at 28 cu. ft. Bond is transported to mixer in precisely measured quantities which can be changed instantly. May be located at floor level, or below, any distance from mixer. Ideal for multiple mixing units operating from same hopper.



HARTLEY CONTROLS CORPORATION

NEENAH, WISCONSIN

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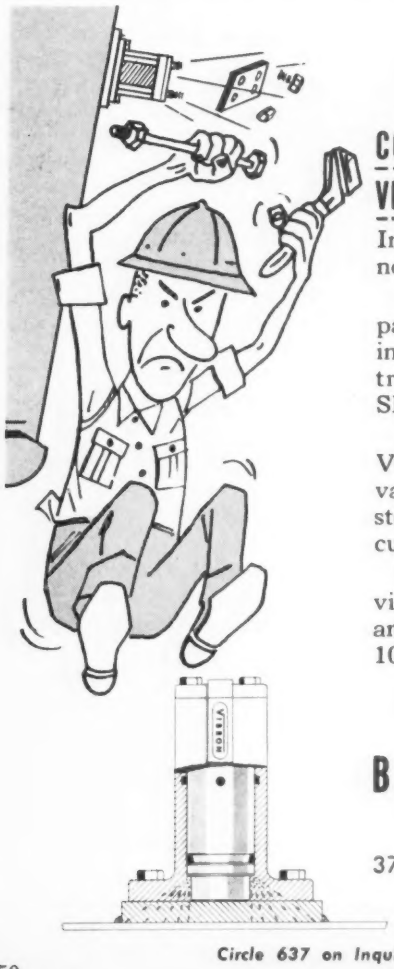

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Circle 637 on Inquiry Card—Page 201

on specialty metals development and manufacture. Present plans anticipate a doubling of the department's cemented carbide and permanent magnet operations during the next 10 years.

International Molding Machine Co., La Grange Park, Ill., has appointed Carl Beers as agent for the territory of eastern half of Michigan. His headquarters are at 19021 Hillcrest Blvd., Birmingham, Mich. M. A. Bell Co., 217 Lombard St., St. Louis, will represent International in southern Illinois, Missouri, Kansas, Nebraska, Colorado, Arkansas, Oklahoma, Texas, Louisiana and parts of Kentucky and Tennessee.

Metal & Thermit Corp. has moved its general offices to Rahway, N. J., where its eastern regional warehouse and research laboratories also are located. Philadelphia and Newark office operations also have been transferred to Rahway. Executive offices continue at 100 Park Ave., New York.

Frank G. Hough Co.'s Model HH Payloader was the subject of one of three industrial design awards made recently by the Industrial Design Institute. The award went to Jon W. Hauser, St. Charles, Ill., for his design work on the front-end loader, which was introduced in 1955.

Koehring Co., Milwaukee, plans to acquire Hydraulic Press Mfg. Co., Mount Gilead, O., through statutory merger for in excess of $5 million. H-P-M products include die casting machines as well as various types of presses.

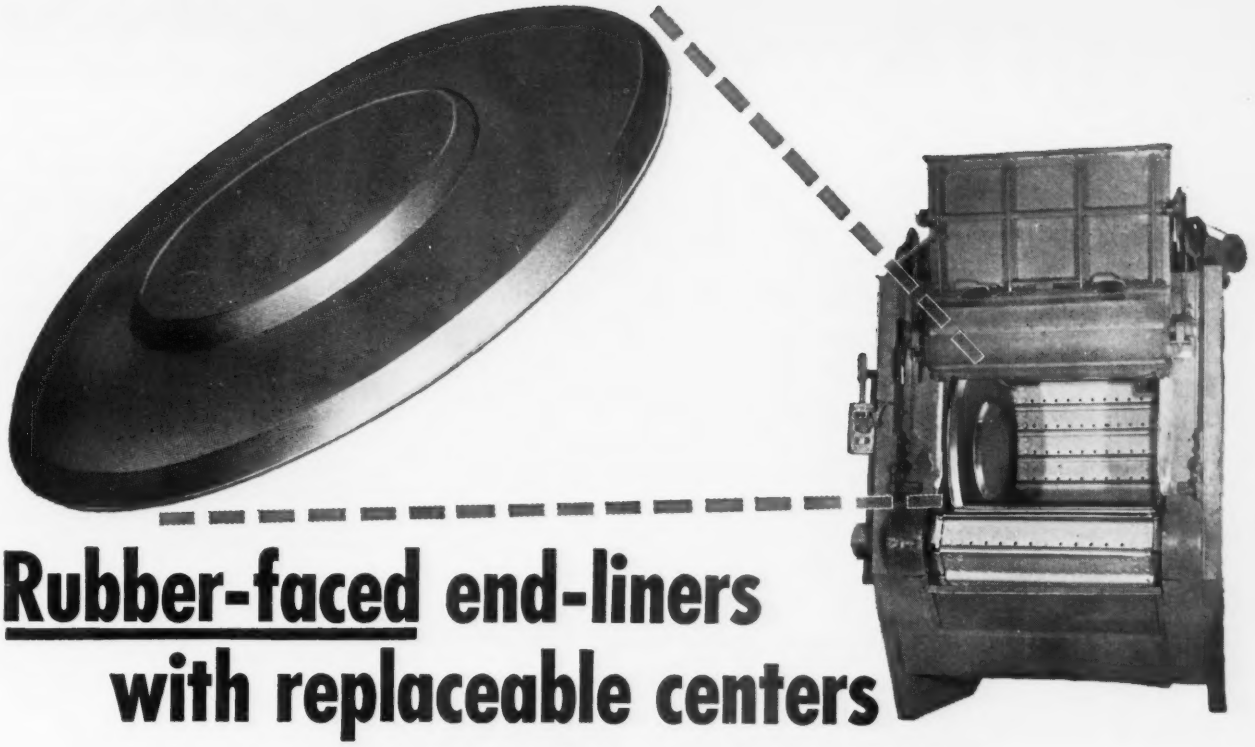
Stearns Mfg. Co., Milwaukee, producer of magnetic drums and separators, has been sold to the Indiana Steel Products Co., Valparaiso, Ind. It will be operated as the Stearns Magnetic Products Division.

Planet Corp., Lansing, Mich., is starting a plant addition to increase manufacturing space by more than 50 per cent. The company designs, fabricates and installs material handling systems.

Royal Pattern Works Co., Cleveland, plans construction of a 7000 sq-ft building later this year on a site to be selected later.

Allen County Pattern Works Inc. has moved from 131 West Spring St., Lima, O., to 814 Fairview Ave., that city.

Peat Mfg. Corp., Norwalk, Calif., producer of die castings, has been acquired by Textron American Inc.



Rubber-faced end-liners with replaceable centers

...cut shot breakage up to 50%

...greatly increase end-liner life

With Gates rubber-faced shot blast discs you make BIG savings two ways:

1. **You save on shot because the rubber disc cuts shot breakage.**
2. **You save time and cost in making end-liner replacements.**

Here's why:

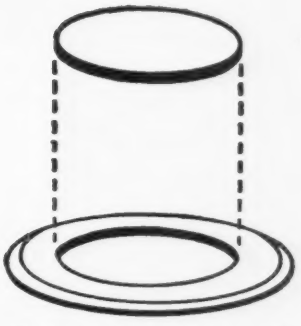
Heaviest wear on end-liners in shot blast and tumble blast machines comes in the center area. With either of Gates two types of disc (center patch, or hollow center), you replace only the center area as needed. Two or three center discs can be used before the main disc is finally worn through.

This important engineering development has increased end-liner service life up to FOUR TIMES.

And rubber protection of end-liners reduces shot breakage as much as 50% — giving you substantial savings on shot replacement costs.

For complete size and cost data, call your local Gates representative . . . or write to The Gates Rubber Co., Sales Division, Inc., Denver, Colorado.

The Mark of Gates Specialized Research



Hollow Center Disc with Patch Plate

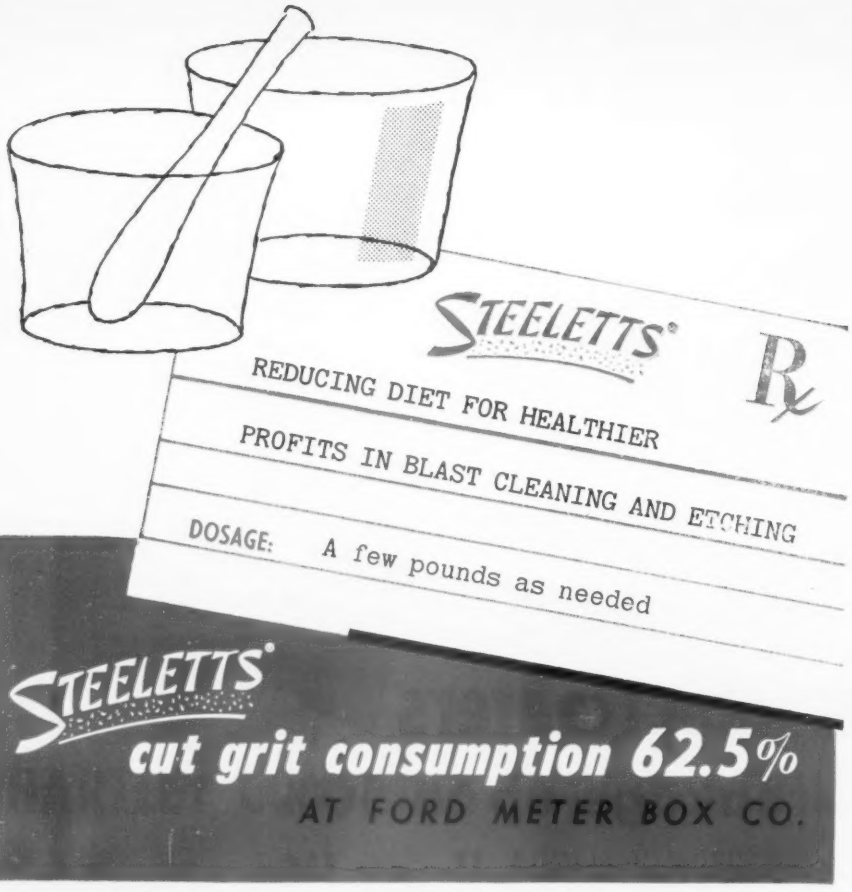
Center disc is recessed flush in hollow center of main disc. Center can be replaced without replacing entire end-liner.

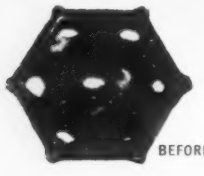
Solid Disc with Center Patch

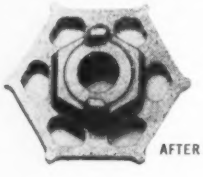
Both discs easily bolted to main structure of shot blast machine.

Gates Rubber-Faced Shot Blast Discs

TPA 103







Steeletts have brought the stamina of steel to grit blasting and are rewriting the story of grit consumption. At Ford Meter Box Co. of Wabash, Indiana, for instance, 75 lbs. of Steeletts do the work of 200 lbs. of chilled iron grit in cleaning and etching non-ferrous castings. This 62.5% reduction in abrasive consumption results from Steeletts' resistance to breakdown.

Chilled iron broke down quickly into fine particles which were drawn off by the dust collector, causing frequent addition of new grit. The Indiana firm also reports Steeletts have produced a better finish on the castings while reducing abrasive consumption.

Wherever an etched finish is required, Steeletts bring savings in cleaning time, abrasive consumption and equipment maintenance. Let them make savings for you.

Write today for Bulletin No. 901-D.

WHEELABRATOR
CORPORATION

World's Largest Maker of Airless Blast Equipment and Steel Abrasives

505 South Byrkit Street Mishawaka, Indiana

Circle 639 on Inquiry Card—Page 201

A Good Promotion Policy Holds Capable Employees

How Haphazard Promotions Can Hurt Your Business

By Ernest W. Fair

HANDLING employees has become almost a science, by sheer necessity. Some years ago, haphazard methods could be used without too much damage in almost any company, but not today. The absence of such an important thing as a planned promotion policy based on tested principles of merit may result in loss of the top segment of a firm's staff.

Each program for promotion must be based on individual considerations of each specific firm. Application of a generalized system is inadequate not only from the management standpoint, but from that of employees as well. Good promotion policies today must be custom tailored to fit the individual firm.

Several factors, however, should be an important part of any such policy. Their use is bringing results today. Failure to use them costs a firm profits in the form of loss of top personnel as quickly as the men and women involved develop to full efficiency.

Basic Policies—Here are the major policies which belong in each firm's promotional program. As stated above, they should be adapted to the individual requirements of each concern.

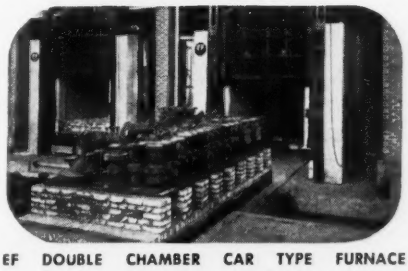
Set up a published policy of promoting from within the company organization. It's the only way to hold onto good employees to begin with—as a policy. Many firms work on such a basis, but never bother to inform new personnel. As a result, a good individual, brought to peak efficiency after an expensive training period, is lost to competition before he finds out about such opportunities within his own organization.

This policy should be set forth clearly to the employee at the time he is hired. It should be repeated by every means available and particularly emphasized in actual practice and by seeing to it that everyone on the staff knows about every such promotion actually made "from the ranks."

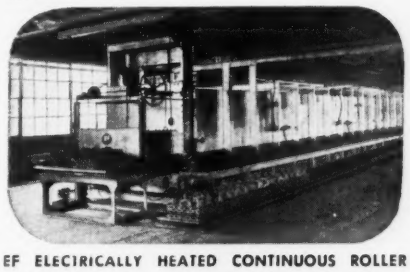
Knowledge that deserved promotions are being made always increases the interest of other employees in the company as well as their desire to serve the interests of the firm. Experience has shown definitely that it also causes other employees to feel that their turn will come next; therefore they remain with the shop

EF FURNACES

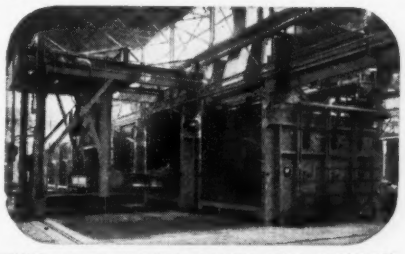
for EVERY Foundry Heat Treating Requirement



EF DOUBLE CHAMBER CAR TYPE FURNACE for annealing castings, equipped with three furnace cars and one transfer car incorporating car puller. Built by The Electric Furnace Co., Salem, Ohio.



EF ELECTRICALLY HEATED CONTINUOUS ROLLER HEARTH FURNACE for the scale-free annealing of various iron alloy castings in special atmosphere. Built by The Electric Furnace Co., Salem, Ohio.



EIGHT EF FUEL-FIRED BATCH TYPE FURNACES, showing gantry crane that handles the large, heavy castings into and out of the furnace and quenching equipment. Built by The Electric Furnace Co., Salem, Ohio.

Foundry Bulletin No. 461

shows typical installations of EF Gas-fired, Oil-fired and Electric Furnaces

Send for a copy today!

THE ELECTRIC FURNACE CO.

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GAS-FIRED, OIL-FIRED AND ELECTRIC FURNACES FOR ANY PROCESS, PRODUCT OR PRODUCTION

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Circle 640 on Inquiry Card—Page 201

and labor turnover is reduced.

How To Use Seniority—Use seniority, but not as the *sole* standard for promotion. Many firms are using a straight-seniority rating as a basis for promotion. This practice is provided for in many union contracts.

It is not, however, a good sole basis for promotion. Too often it passes over a much more qualified individual, and it also serves to discourage ambitious younger men and women on the staff.

In actual practice, most firms find that seniority coupled with ability is a better standard to follow. Some frequently give the eligible individual a week or ten days in which to qualify for the job. Others hold examinations for such posts among the top 10 or 20 on the seniority list. This system helps to make certain that the best available individual is secured for the job, rather than simply the oldest on the staff at the time.

Make certain that the qualified employee gets the first chance at the job. Where we fail to follow such a policy, we might as well not have any promotion program. The whole structure is destroyed by overlooking the best qualified man or woman when a promotion becomes available.

No matter how much a man or woman may love the work he is doing, his best incentive still is the hope for a better job and more salary. Each time an individual obviously less qualified than others is promoted, faith in such a future is destroyed for that particular employee.

Opportunity to learn the information needed to hold the better job should be made available to men and women in line for promotion to that position. Where the nature of their work stifles such an opportunity, we not only make it difficult for them to attain personal goals, but the company also loses through promotion of unqualified individuals. It is much easier to learn ahead of the job than on it, particularly in the instance of any executive position—even a minor one.

An understudy system of promotion is used today by many concerns and deserves consideration in our promotion policy. Under it, particularly eligible personnel are given the opportunity to work at the tasks that would be required of them in the next eligible position. This work not only shows the employee that the firm has faith in his future and that he has a definite opportunity for promotion ahead, but it also helps to train such individuals in advance so that little break-in will be required when the promotion is actually made.

Don't Use Hunches—Keep the "hunch" system out of the promotion

Q. Which steel shot provides

FASTEST CLEANING

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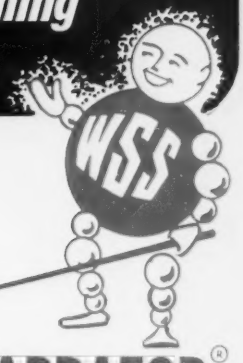

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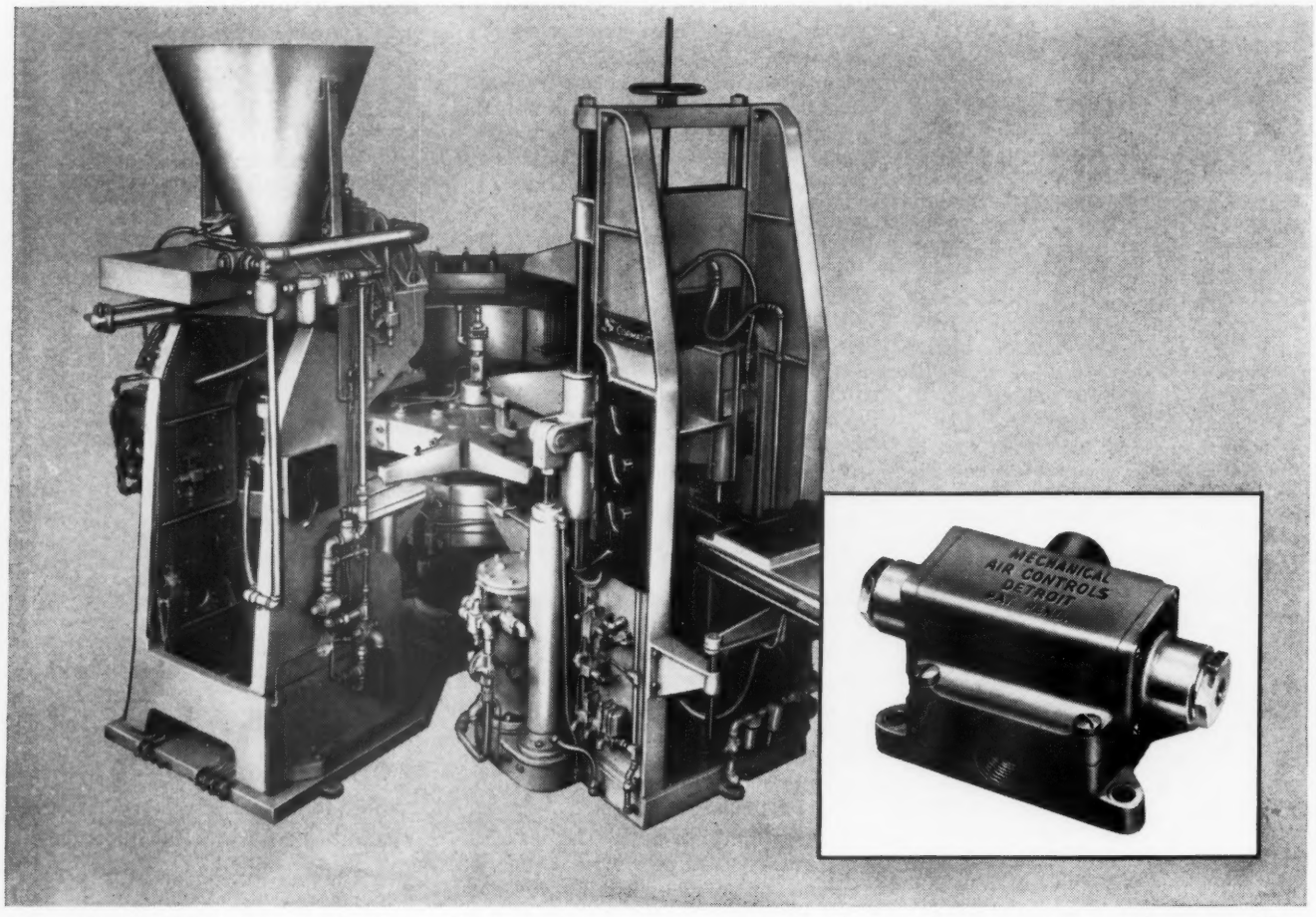

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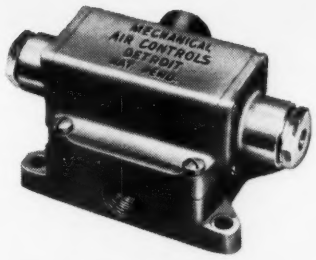

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program. Such a policy can be too easily influenced by current events or happenings during the week closest to the time of actual promotion. Every firm should have an organized program to implement its promotional system through personnel records which can serve as a guide for promotions at any time. Thus the executive always has the whole picture before him, not the most recent in kept by even the smallest shop, which will find them as valuable as any.

Promote men on their qualifications for new jobs—not for their old ones. Failure to use this method has been one of the gravest mistakes made in business. We too often judge an individual solely on top performance in the post he holds now. This performance never can be assurance that he will be as good on the next step up the ladder.

It always is safest to consider not only his qualifications on his present job, but also those for the new job. Doing so gives us more assurance that the person we select will be the right individual.

Judge Real Performance—Superior employee performance should be judged carefully for its reality. In many instances a picture of such performance can be woven without actually existing beyond a degree. It always is good policy to make certain not only that the employee's performance actually has been superior, but that this superior performance has been typical of that particular individual.

Tests sometimes are advisable before a definite promotion is made. These may be in the form of written examination to ascertain how much of the required knowledge and skill each individual actually has for the job under consideration. A more practical form is to try out the employees being considered in the more important duties for which they appear to be qualified. In most cases, this can be done by giving out specific assignments without letting the employee know that he is under consideration for such a promotion. Following this course will give a truer and more accurate picture than if the employee is told that the test involves a possible promotion.

In addition, it has been found good procedure to sell the promotion policy to employees as a good one, to use employee progress reports where possible or even a formal merit rating plan and to provide definite lines of promotion.

Each of the foregoing factors should have an important part in any firm's program or policy. They form the basic framework to which can be added others of specific concern to the individual company.

It takes a full flow of sand to keep casting production at a high level. When sand chutes like these plug up, production ceases. The molder gets mad, you get mad and your customers get mad.

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Circle 642 on Inquiry Card—Page 201

Dr. A. B. Everest, right, retiring president of IBF, presents the E. J. Fox Medal to F. W. E. Spies, president, Netherlands Foundry Technical Association

H. J. V. WILLIAMS
President

JOHN BLAKISTON
Senior Vice President

ARTHUR E. PEACE
Junior Vice President

IBF MEETS IN WALES

For 53rd Annual Convention

By VINCENT DELPORT
European Editor

CARDIFF, the capital of the principality of Wales, was the site of the 53rd annual convention of the Institute of British Foundrymen, June 12—15. The prosperity of Cardiff grew from its coal fields and its shipping activities, and South Wales is now an important center of steel production, mainly strip and tin plate. There are also a number of important foundries. The city is notable for one of the finest civic centers in the British Isles.

The convention was particularly well attended, largely on account of the personality of the new president of the Institute, H. J. V. Williams, whose uncle, the late C. E. Williams, was the well remembered president of the Institute in 1933, and whose name is associated with the annual Edward Williams Lecture.

The proceedings started with a reception by the Lord Mayor and Lady Mayoress of Cardiff at the City Hall, on the evening of June 12, when the visitors were treated with a musical program a special attraction of which was the fine singing for which the Welsh are well known.

The annual general meeting of the Institute was held on the following morning, with Dr. A. B. Everest, the retiring president, in the chair. The annual report disclosed a total membership of 5638 as of April 21, compared with 5469 a year ago.

The chairman announced the awards of 1956 medals and prizes, details of which are given on a following page.

The John Bell scholarship was awarded to Ian Earnshaw, student of metallurgy at the Royal Technical College, Glasgow.

Diplomas were awarded to J. A. Wilkins, of the East Midlands branch, for his paper on "Dust and Fume Extraction in Foundries" and to J. McGrandle, for his paper on "Scrap Investigation" given before the Scottish branch.

It was also announced that Dr. J. E. Hurst, prominent past president of the Institute, was in Germany to receive the degree of Doctor of Engineering *honoris causa* from the faculty of Karlsruhe, and that V. C. Faulkner, also a well known past president of the institute, had been elected an honorary member of the German foundry technical association. Both count many friends among American foundrymen.

The meeting then proceeded to the election of these officers for 1956-57:

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President—H. J. V. Williams, joint managing director of John Williams & Sons (Cardiff) Ltd.; Senior vice president—John Blakiston, engineer and foundry consultant, Halifax; Junior vice president—Arthur E. Peace, a director of Ley's Foundries & Engineering Co. Ltd. and its subsidiaries, Ley's Malleable Castings Co. Ltd. and the Ewart Chainbelt Co. Ltd., Derby.

Members elected to the council for a period of two years were: H. G. Hall and M. M. Hallett, of the Birmingham branch; R. L. Handley, of the Lancashire branch; Ben Hird; R. F. Horton, of the Sheffield branch and W. G. Mochrie, of the London branch.

Dr. Everest then inducted the new president, H. J. V. Williams, into the chair. Mr. Williams is a past president of the Wales & Monmouth branch of the Institute. He has served for many years on the General Council, on many committees of the Institute, and also on the council of the British Cast Iron Research Institute. He has been active in the field of education and training in the foundry industry. After proposing a vote of thanks to Dr. Everest for the way in which he had fulfilled his duties as president, with the additional responsibility involved in the holding of the International Foundry Congress in London in June, 1955, Mr. Williams delivered his presidential address.

Discusses Problems of Industry

He dealt mainly with the difficulties that the industry has to face, which are peculiar to our times—the changing quality of fuels, new legislation, new techniques, or a changing economy. He said, however, that we might encourage ourselves by recalling the cares of our predecessors.

There are numerous examples of progress being achieved through particular developments being carried out independently yet simultaneously. It is only in comparatively recent times that organized group research has developed. At the same time, there is continuity in the development of progress, and a discovery by one man is almost always brought about by knowledge gained from similar work done in the past.

Dealing with the papers given before technical associations, the speaker said that while the result of research must be understood and assimilated by the producers, so must the producers reveal their problems and suggestions to those employed on research. He also stressed the importance of the work carried out by the Technical Council of the Institute. While great strides have been made in the development of various technologies and techniques, there is always the necessity of keeping in step with the requirements of the designer and engineer.

Looking into the future, President Williams emphasized that greater productivity and striving for the highest quality of products is necessary if the present standard of living is to be maintained.

The Edward Williams Lecture followed. This was by W. F. Cartwright, assistant manager, the Steel Co. of Wales, Ltd. His subject was "Use of Castings in a Modern Iron and Steel Works." He indicated, by tables, how the use of iron castings in iron and steel works is limited today to special types, compared with the almost universal use of simple cast iron 40 years ago.

The development of cheap mild steel was probably the biggest influence in the reduction of the use of cast iron. Another major factor was the development of the oxyacetylene torch which made it easy to cut

Recipients of IBF Awards

JOHN STEELE, recipient of the Oliver Stubbs Medal, was educated at Wishaw, Scotland and received his technical education at Stow College of Engineering, Glasgow. He served his apprenticeship as a molder with the Clyde Alloy Steel Co. following which he was employed in the iron and nonferrous foundries of G. & J. Weir Ltd. In 1947 he went to South Africa. In 1949 he became foundry manager of the precision casting department of Rely Products Ltd., Johannesburg. Later he was with Precision Dental Laboratories (Pty.) Ltd., Johannesburg, as manager of the company's investment casting foundry. He is now associated with Foundry Services Ltd., as a South African representative.

F. W. E. SPIES, who was awarded the E. J. Fox Medal, is president of the Netherlands Foundry Technical Association and a past president of the International Committee of Foundry Technical Associations. He began his industrial career in 1920 as a fuel economy engineer. In 1923 he became blast furnace manager with the Royal Netherlands Blast Furnaces & Steel Works Ltd, Ymuiden (Netherlands). His present position is general works manager of the Royal Netherlands Blast Furnaces & Steel Works Ltd., Cemy Ltd., Breedband Ltd., and Mekog Ltd., Ymuiden.

DR. E. R. WALTER, was awarded the Meritorious Services Medal in recognition of 25 years' service to the Lincolnshire section and Lincolnshire branch and for his work in guiding and developing the branch to its present status in the institute. Educated at London University, he served his apprenticeship at the works of Clayton & Shuttleworth, Lincoln. From 1913 to 1919 he served as chief draftsman, National Projectile Factory, Lenton, Notts. He later became chief technical engineer, Wadkin Mills Ltd., Nottingham. In 1921 he became a lecturer at Lincoln Technical College, subsequently being appointed head of the engineering department and, later, college principal.

A. TALBOT, winner of the British Foundry Medal and Prize, has been associated with Western Foundries since 1942 and has been foundry manager since 1953. Before becoming associated in his present capacity, he gained industrial experience at foundries in the Tyneside, Clydeside, Tees-side, Yorkshire, South Midlands, London and Bristol areas. He is senior vice president of the London branch, IBF. His award was based on his paper "Cores and Moulds by the CO_2 Process" which was adjudged the best presented to the Institute during the preceding year.

Circle 646 on Inquiry Card—Page 201→

The gears in an automatic nut former have to be tough and strong to withstand heavy, varying loads. Yet, the castings from which they're made should be easy to machine. That's why this gear for a Waterbury Farrel Automatic Nut Former is made from ASTM-50 gray iron with a nominal composition of 1% nickel and .50% molybdenum.

Moly gives cast iron gears higher strength with toughness and good machinability

"To insure a tough, easily machined gray iron for the gears in our Automatic Nut Formers," says Henry C. Griggs, Metallurgist for Waterbury Farrel Foundry & Machine Co., "we specify .50% molybdenum in our ASTM-50 material. The properties of this material contribute importantly to the reputation of Waterbury equipment for accuracy and high speed production under severe operating conditions."

Molybdenum helps to give reliable and reproducible castings – very important factors in consistent performance of gears.

Investigate moly irons. They may be the key to better performance in many of your gear applications.

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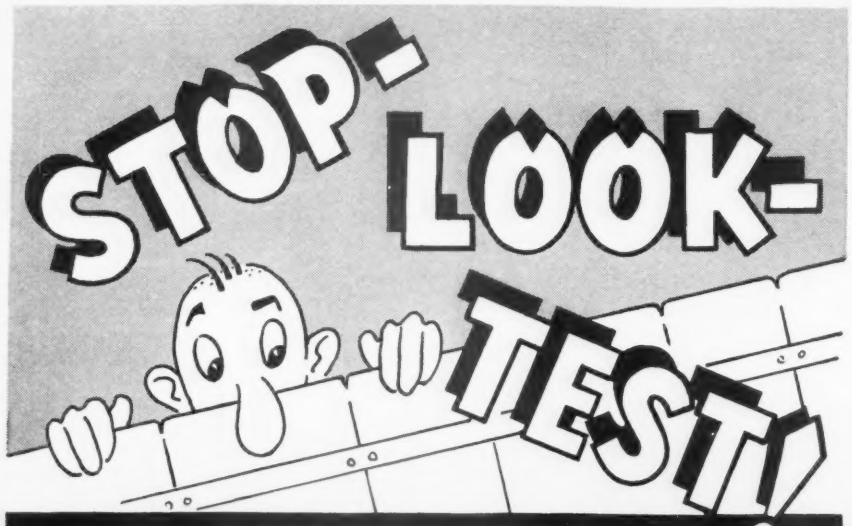

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Circle 647 on Inquiry Card—Page 201

and repair mild steel, but was of little assistance with cast iron. Later came the application of welding for repair work and this, again, further hastened the decrease in the use of cast iron.

In another table the lecturer indicated where steel castings are used today, although there are many cases where it is possible to use a weldment, instead of the casting. On the other hand, it is not usual to substitute weldments for any of the castings in manganese or alloy steel, or for any heat resisting applications.

Turning to the uses of nonferrous castings in the iron and steel industry 40 years ago and today, a table shows that they are still used extensively but in many cases for different purposes. In many applications there is no chance of the bronze casting being supplanted.

Fourteen technical papers were delivered at the convention. Reports on them will be presented next month.

National Fluid Power Group Elects Officers and Directors

Record attendance marked the 1956 annual meeting of the National Fluid Power Association at the Greenbrier, White Sulphur Springs, W. Va., on May 28-30.

Officers elected for the coming year include J. J. Pippenger, Double A Products Co., Manchester, Mich., president; R. J. Murphy, Kalamazoo Division, New York Air Brake Co., Kalamazoo, Mich., first vice president; J. A. Marsh, Rivett Lathe & Grinder Co., Boston, second vice president; and Ellwood G. Peterson, Hannifin Corp., Des Plaines, Ill., treasurer.

Directors elected for three-year terms are J. R. McGuire, Waterman Engineering Co., Evanston, Ill.; William C. Richards Jr., Bellows Co., Akron, O.; and S. B. Taylor, Parker Appliance Co., Cleveland. C. R. Pittman, Hydraulic Power Division, Hydraulic Press Mfg. Co., Mt. Gilead, O., was elected a director for one year to fill a vacancy.

Barrett Rogers, 1618 Orrington Ave., Evanston, Ill., is executive secretary.

Airmatic Valve Co. Moves

Airmatic Valve Co., Cleveland, has tripled its facilities by moving to a new location at 7313 Associate Ave. Currently a manufacturer of air-controlled valves, the company also is tripling its engineering staff to prepare for additional product items in the valve field.

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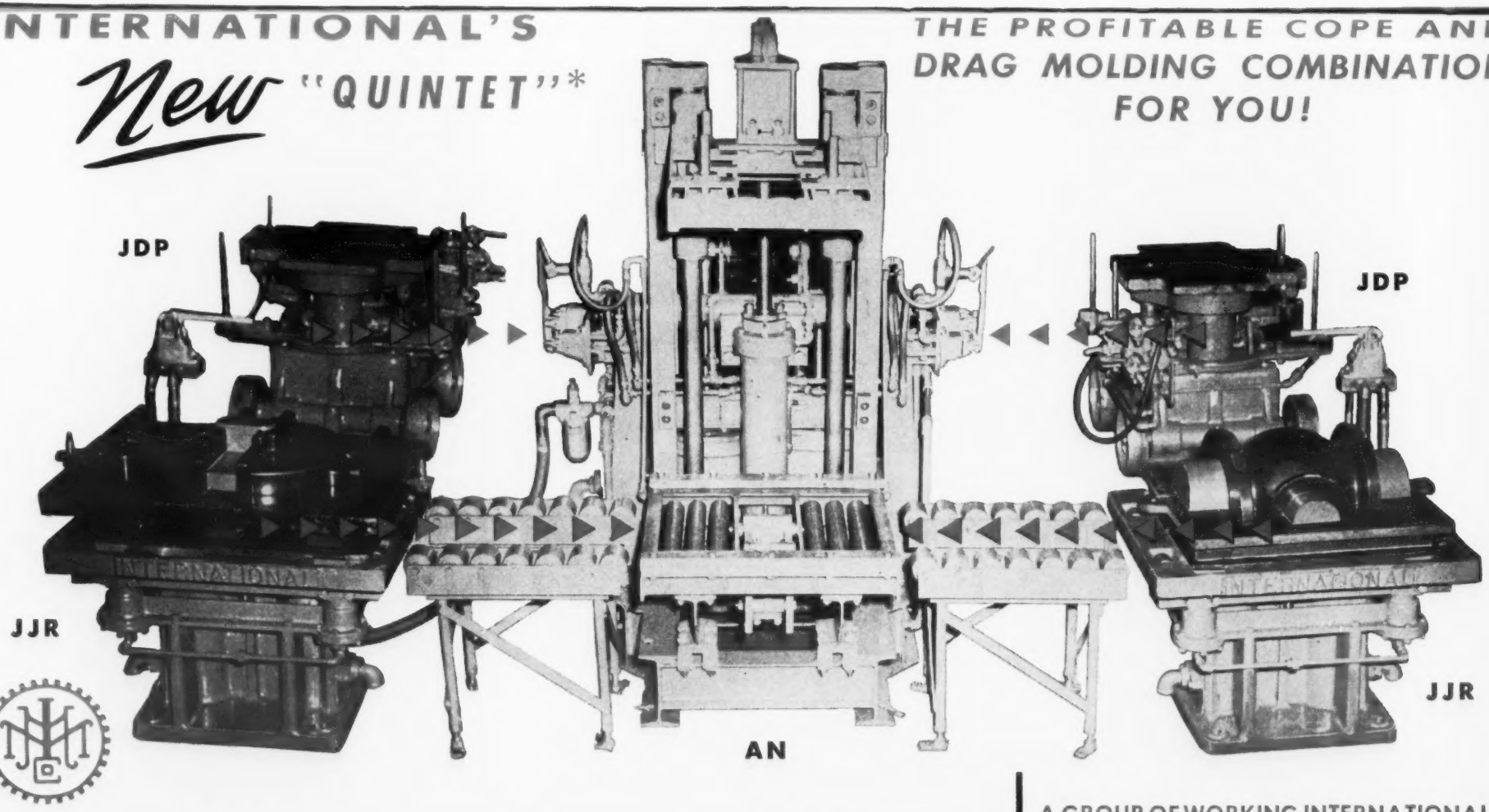

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Adaptable to large range of work suitable to pin lift style and readily adjustable. Exclusive feature is its positive jolt and true ram accomplished by use of double jolt section combined in one integral part. Will handle loads from 750 lbs. to 3000 lbs.

AN—TURNOVER and DRAWING MACHINE

For clamping and turning over core boxes or flasks and for drawing the core or mold. Easily handles hard-to-draw, short runs and many different sized jobs. No rigging time is required. Capacity—750 lbs. to 10,000 lbs.

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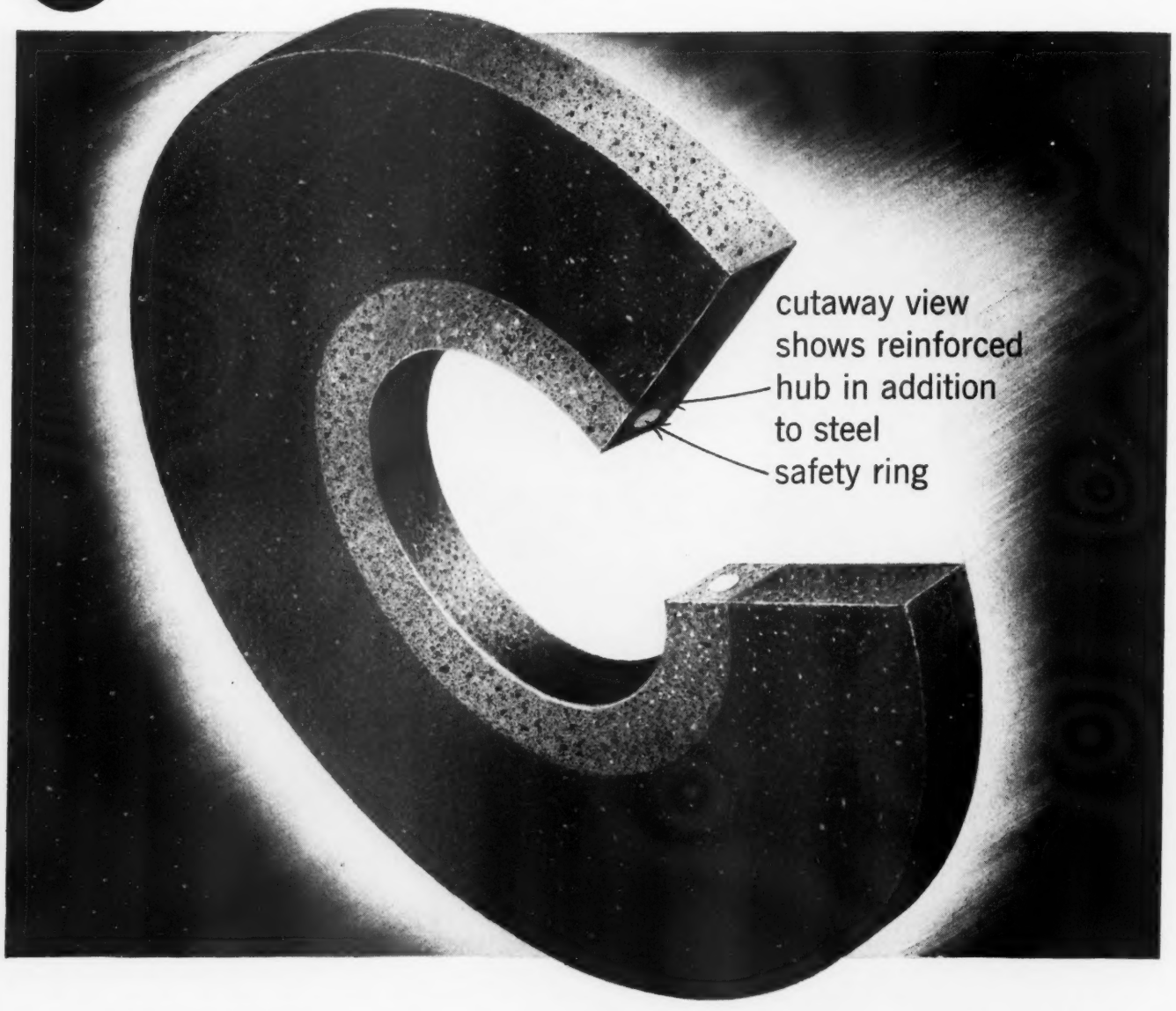

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Around the Country

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Syracuse . . . Detroit . . . Philadelphia . . . Chicago . . . New York . . . Pittsburgh

Pittsburgh—When the strike of basic steel producing firms began July 1, it had no immediate effect on foundries here. The principal supplier of merchant pig iron to Pittsburgh foundries has a labor contract extending through Aug. 31, and contracts of most foundries here won't expire until late in the third quarter.

In May and June, foundries bolstered their stocks of pig iron and scrap in anticipation of a possible price increase. Stocks are considered large enough to meet foundry needs for 30 to 45 days. A shortage of merchant pig iron would occur if the steel strike lasted beyond Aug. 1, a foundryman commented at the time that the strike began.

Foundrymen allowed their stocks to decline in early July, causing a drop in demand for merchant pig iron. Further slowing the local market were widespread vacations at foundries here during the first two weeks of that month. Small jobbing foundries were quite inactive during that period.

Not all foundries experienced slowdowns in July. Mesta Machine Co., with a $100 million order backlog, continues to work as close to capacity as possible. Other equipment builders report that they have a strong backlog of orders from expanding aluminum and steelmaking industries.

Syracuse— New York state's 20,000-worker foundry business, which pays average annual workmen's compensation costs of $3,000,000, has been selected by the State Labor Department for launching an industry-by-industry series of co-operative safety programs employing the latest accident prevention techniques. The foundry industry has the largest employment of any of the state's top 25 high-hazard industries.

Besides the workmen's compensation costs to management, workers in foundries are said to sustain an average annual loss of more than $750,000 in wages because of accidents.

A task force of 60 safety service men, selected from the department's regular personnel and given special training, has started visiting the state's more than 300 foundries to enlist co-operation in the new approach to accident prevention.

An industry-wide open meeting of the newly organized Foundry Safety Advisory Committee was held in Syracuse June 12. At this meeting Industrial Commissioner Isador Lubin, labor department head, told the foundrymen that the department is adopting a new approach to safety because studies of accidents in their industry and generally have shown that more than two-thirds of all compensable accidents can be attributed to circumstances outside the scope of regulation by law and the Industrial Code.

Enforcement and inspection will not be neglected, Commissioner Lubin said, but "we need to raise our sights and superimpose on the inspection system a realistic plan for promoting all aspects of worker safety."

"The accident frequency rate for the foundry industry," he said, "is better than double that for all manufacturing; triple that for the high-hazard chemical industry; and more than seven times as great as the rate for blast furnaces, steel works and rolling mills."

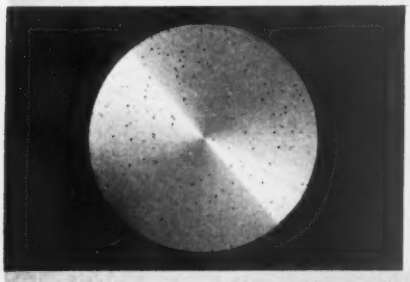
The department's advisory committee is made up of representatives of both industry and labor, as well as of the American Foundrymen's Society, Gray Iron Founders' Society, Inter-Allied Foundries of New York State and the Metropolitan Brass Founders' Association. A representative from each of the five New York AFS chapters is serving on the committee.

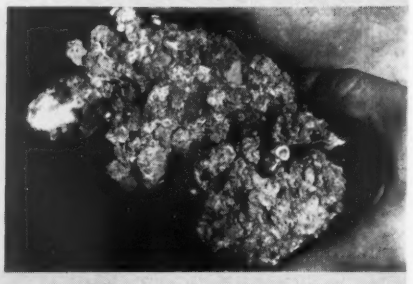
Philadelphia— Foundry business is in the summer doldrums. Various foundries closed down in July for mass vacations, for periods ranging usually around two weeks; others have similar schedules planned for August. Moreover, hot weather is having the usual retarding effect on production. The situation this summer has been further disturbed by the steel strike, which has disrupted schedules in the metalworking industry well beyond the immediate confines of the steel producing industry itself.

In gray iron, business in heavy work, such as for presses, papermaking machinery and steelmaking equip-

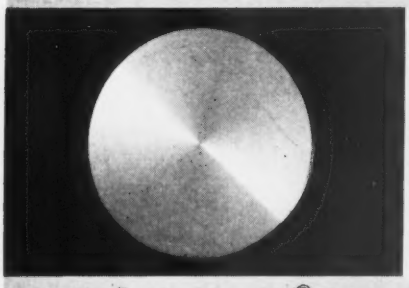
FOUNDRY SAFETY: An open meeting of the Foundry Safety Advisory Committee, New York State Labor Department, was held at Syracuse, June 12. Among those present were, left to right: Milton D. Emery, Buffalo Pipe & Foundry Corp.; Industrial Commissioner Isador Lubin, Department head; Richard H. Beyer, secretary, Inter-Allied Foundries of New York State; Edwin W. Burne, Schenectady foundries, General Electric Co., and chairman of the national safety committee, Gray Iron Founders' Society, and Charles J. Quick, Tioga Foundry Corp., Owego

Costly gassy and oxidized aluminum castings and metallic drosses like these





are eliminated



with Foseco® Coverals and Degasers

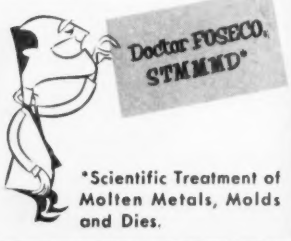
And it's so easy to produce sound aluminum castings the FOSECO way. Just:

(1) Heat crucible and charge ingot and/or scrap.

(2) Dust on a layer of FOSECO COVERAL.

(3) Melt charge completely and plunge FOSECO DEGASER TABLETS.

(4) Dross-off with another small quantity of FOSECO COVERAL.



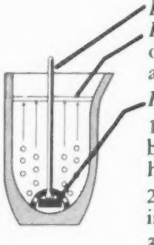
*Scientific Treatment of Molten Metals, Molds and Dies.

THE PROBLEM

Tough oxide film which forms on the surface of untreated molten aluminum.

Suspended particles of oxide (alumina), some of which are in contact with hydrogen gas. The oxide film prevents the hydrogen from rising to the surface.

THE SOLUTION



Plunger

Foseco Coveral Flux has absorbed the oxide into the dross which can be easily and cleanly skimmed.

Foseco Degaser decomposes to:

1. Liberate chlorine vapors which combine with and effectively remove the hydrogen.
2. Sweep all other impurities, including oxides, to the surface.
3. Break the surface tension of the metal by dissipating the oxide film, completely removing the last traces of gas and entrained oxide from the melt.

THE RESULT

A clean, gas and oxide-free aluminum melt, ready for pouring. Drosses are exceptionally low in metallics, fluidity is improved and strong, pressure-tight castings are produced.

FOUNDRY SERVICES, INC.

2000 BRUCK STREET — COLUMBUS 7, OHIO

In Canada: FOUNDRY SERVICES (CANADA) LTD., 201-7 Alice St., Guelph, Ontario

Send this coupon for these free leaflets giving all the facts about treating aluminum alloys.

Name_____

Company_____

Address_____

City_____ State_____

Circle 650 on Inquiry Card—Page 201

ment, is still running well ahead of light work. Cast pipe shops are running well, with due allowances for vacations and hot weather. The average job shop has about three weeks' backlog, it is estimated.

Steel foundries are operating on a 5-day week with backlogs of around eight weeks. There is some easing in demand, but this is offset insofar as backlogs are concerned by warm weather and vacations. Bookings at the malleable shops reflect much the same situation, holding relatively steady, averaging seven weeks or so. Pipe fittings, builders hardware and railroad equipment constitute the bulk of malleable demand in this area. Nonferrous shops are doing well considering seasonal drawbacks.

Chicago—Of interest to midwestern foundries which examine castings by radiographic methods and conduct research on the structure of metals should be the announcement that Armour Research Foundation of Illinois Institute of Technology began operating its new nuclear reactor June 28. This is the nation's first private reactor for industrial research and will enable industry for the first time to conduct reactor studies without security restrictions and military competition.

The reactor is a neutron and gamma ray source and its most frequent use probably will be in the production of short-lived radioisotopes. Since over 50 per cent of all neutron-induced radioisotopes have half lives less than one day, advantages of having the source of such radioactivity immediately at hand are obvious.

The Armour reactor is the first since the original reactor at Stagg Field, Chicago, to be constructed in a highly populated area. It is housed in a new $1.25 million Physics and Electrical Engineering Research Building on Chicago's near south side. It was built by Atomics International, a division of North American Aviation Inc., Canoga Park, Calif.

Housed in a room 72 ft long, 48 ft wide and 30 ft high, the reactor is a "water boiler" type capable of operating at a power level of 50,000 watts. It is not intended for generation of electrical power, nor for research on reactors themselves. It employs fuel in the form of a water solution of uranyl sulphate — approximately one kilogram of U-235. The fuel has been obtained from the Atomic Energy Commission on "extended loan," as required by law.

Twenty-four industrial companies are participating in the nuclear reactor research program at Armour. Under the participator plan, each firm is contributing $20,000 toward the construction and initial operation

Circle 651 on Inquiry Card—Page 201 →

Exclusive with the Heroult:

100% Mechanical Operation

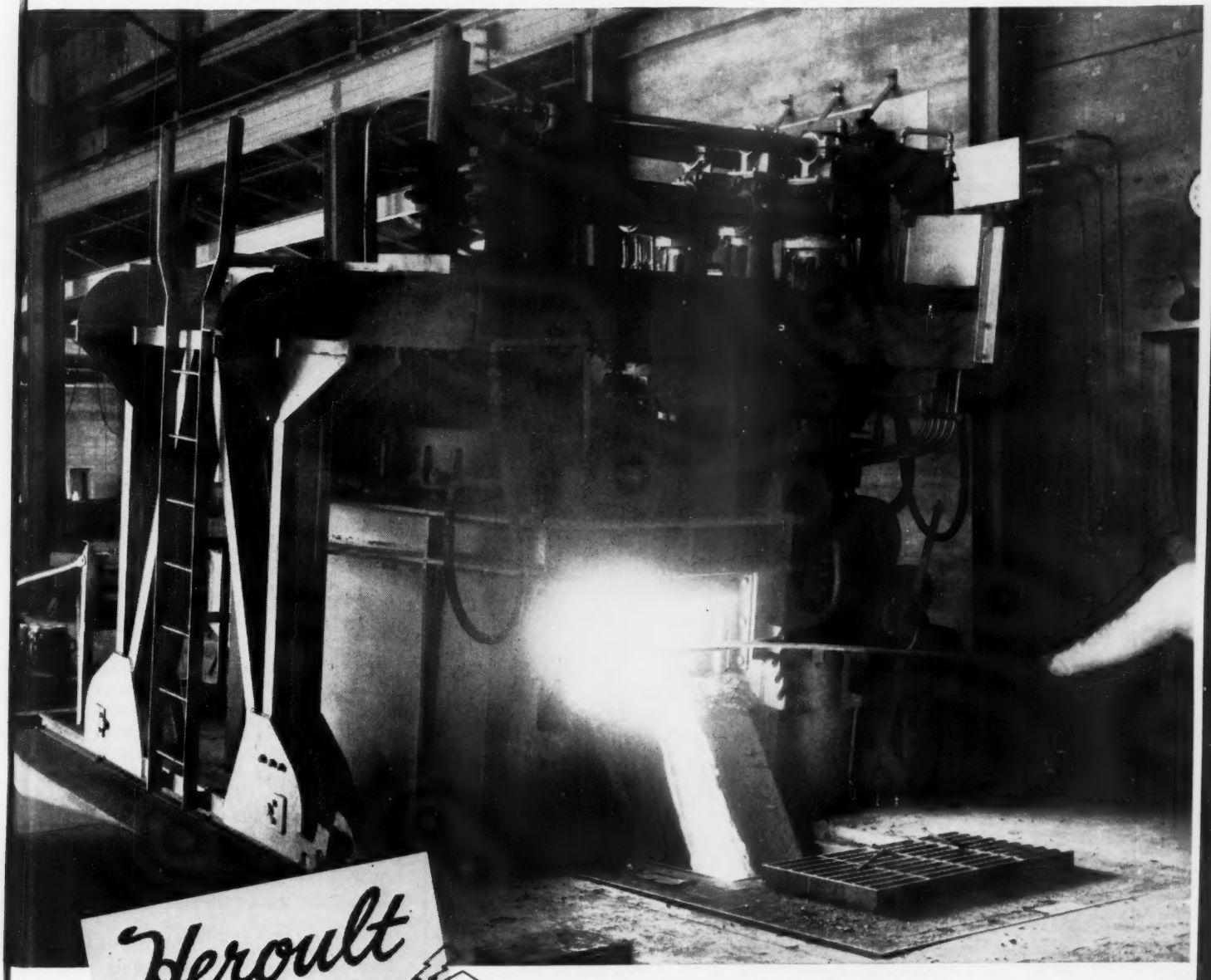
The Heroult is the *only* 100% mechanically operated electric furnace on the market! All of the movements are handled by motor-driven gear mechanism.

This is a very important advantage—as any engineer will readily tell you, for it eliminates so many maintenance difficulties.

There is nothing about the operation and servicing of the motor-driven, heavy-gear mechanism of the rugged Heroult that any good maintenance man can't easily take care of himself. Seldom, if ever, will you find it necessary to call in an outside maintenance man to keep your Heroult performing efficiently.

Modern Heroult electric furnaces are available in sizes ranging in holding capacity from 6,000 lbs. up to and in excess of 400,000 lbs. Both gantry and swing-type roof-moving mechanisms are available. Door-charging furnaces and furnaces of special design, including units equipped with austenitic steel bottoms to permit induction stirring, can also be supplied.

We welcome an opportunity to help you select and install the Heroult best suited to your requirements. An inquiry to the nearest office will bring complete details.



Heroult

ELECTRIC MELTING FURNACES

USS

AMERICAN BRIDGE DIVISION

UNITED STATES STEEL CORPORATION, GENERAL OFFICES: 525 WILLIAM PENN PLACE, PITTSBURGH, PA.

Contracting Offices in New York, Philadelphia, Chicago, San Francisco, and other principal cities.

United States Steel Export Company, New York

SEE THE UNITED STATES STEEL HOUR. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

UNITED STATES STEEL

of the $700,000 reactor facility. In return, the companies will share in the benefits of an extensive three-year program whose aim is the application of atomic techniques to industrial problems.

Among participants are Caterpillar Tractor Co., Peoria, Ill.; Clark Equipment Co., Buchanan, Mich., and United States Steel Corp., Pittsburgh.

Dr. Richard F. Humphreys, assistant director of Armour Research Foundation, is director of the reactor program.

* * *

A month ago, this column reported the prospect that Peoples Gas Light & Coke Co. likely would shut down the coke ovens at its Crawford Ave. station and no longer be a producer of foundry coke. This action was taken the last week in June and the company has no plans for further operation of the facilities.

Miller & Co., who had been exclusive sales agent for the company's foundry coke, will continue to serve its customers with coke obtained from other sources.

With cessation of the Peoples Gas operation, no foundry coke is being produced in the Chicago area. Closest sources now are Milwaukee, Indianapolis and Terre Haute, and some will be shipped into the area from as far away as Alabama.

On July 1, the company began supplying domestic users of gas in Chicago with 100 per cent natural gas, instead of a mixture containing 10 per cent coke oven gas. Elimination of this need for manufactured gas made continued operation of the coke ovens unnecessary. In addition, the company has canceled contracts with Youngstown Sheet & Tube Co., Republic Steel Corp. and Interlake Iron Corp. for purchase of surplus coke oven gas.

Peoples Gas has conducted a coke oven operation for 35 years and had three batteries of Koppers ovens. Two of these batteries, of 50 ovens each, were old and last operated about two years ago. The third was a modern battery of 51 ovens built in 1948 at a cost of $4.6 million.

* * *

Seventh among the top 10 Junior Achievement firms in the Chicago area is the Busy Bee Foundry Co., sponsored by Crane Co. Products of the company are garden trowels, trivets and door knockers. Judging was based on the annual reports submitted by 246 companies manned by about 5000 youngsters.

Detroit— Buick Motor Division is modernizing the dust collection system of its Flint foundry. It involves overhauling of present equipment and the installation of some additional units. Present facilities include 49 wet type collectors which are served by seven pumps having a total capacity of 6800 gallons of water a minute.

One of Buick's six molding lines has been modernized and a second line is in the process of being equipped with new collectors at three shakeouts. The four others will be treated similarly. An extra pump has been installed to supply additional water required when the size of nozzles in the dust arresters of six cupolas was doubled.

Coke and stone handling equipment also has been equipped with new dust collecting systems.

* * *

Ford Motor Co. will start early next year to build a new propulsion laboratory for gas turbine and free piston engine testing. It will provide an additional 70,000 square feet of test area for this work.

The structure will include 12 main cells and ten dynamometers for testing engines up to 1000 horsepower. The new building will be a part of the Ford Research and Engineering Center in Dearborn, Mich.

* * *

Detroit's National Industrial Exposition, to be held Oct. 22-26 at the Detroit Artillery Armory, will feature a Metals Day on Thursday, Oct. 25. A management-engineering conference by a panel of manufacturing experts will cover new ideas for industry in the fields of metals and metal products.

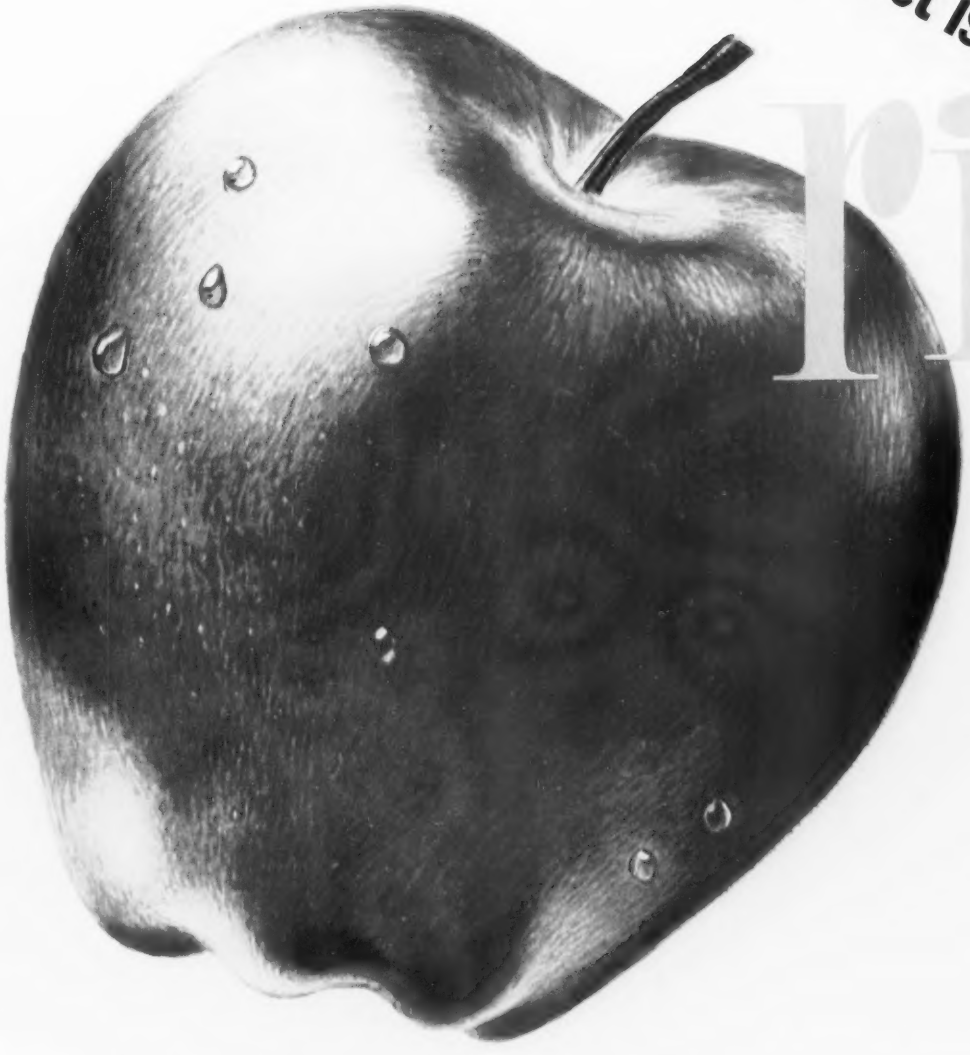
The exposition will feature various kinds of new industrial products, new methods and research developments. It will be open from 11:30 a.m. to 5:30 p.m. daily. Exposition headquarters are at 927 Book Bldg., Detroit 26.

IN THE PUBLIC EYE: The display shown here has done an effective publicity job for Wayne Aluminum Foundry & Machine Co., Garden City, Mich., and incidentally for the entire industry. Located in the waiting room area of Willow Run Airport, the Detroit air terminal, the automated foundry exhibit was made by Thomas & Brewer, Dearborn, Mich.

New York— Influenced primarily by seasonal conditions, casting production in this district continues to lag. With more vacations and hot weather still ahead, prospects are that production will remain spotty until after Labor Day. The low point, however, was probably reached in July when a number of shops closed for the July 4 holiday week and the week following. The steel strike also had an upsetting effect, with the full extent of its influence still unmeasured.

Some gray iron shops are operating on four days a week basis, some on five days with limited working forces. Backlogs in most cases do not extend beyond two or three weeks. At least, most foundries are able to work in desirable business within that time. Retarded activity in the construction field, due to the steel strike, has slowed up business

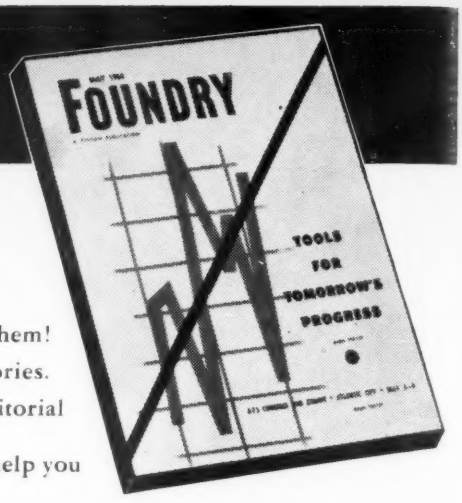
FOUNDRY's market is ripe*



* **It's an exciting opportunity** that deserves more intensive effort now. This dynamic $6 billion foundry market is a part of no other market.
* **Spending is high**—interest and readership are high—when your product story reaches foundrymen through the pages of FOUNDRY magazine.
* **The search is on** for new ideas, methods and products to help 66,000 key buying influences in U.S. and Canadian foundries meet the competition of other fabricating methods.
* **FOUNDRY's complete Sales Development Service** helps you sell this huge market. Ask us about this service.

a PENTON Publication / Penton Building, Cleveland 13, Ohio

How to sell FOUNDRY'S Market



FOUNDRY's unique Plus 5 Sales Development Service for advertisers provides this complete package of market and sales development assistance.

1. We can tell you where every foundry is and all you need to know about them!
2. We can assist you to evaluate your sales performance by your own sales territories.
3. We can supply you with prospect cards made up to your sales and territorial requirements.
4. We can provide you with a list of Foundry Supply Houses and Agents to help you establish more effective distribution.
5. We will add your salesmen and distributor names (and your dealers' names) to our newsletter list to keep them informed on latest foundry developments.

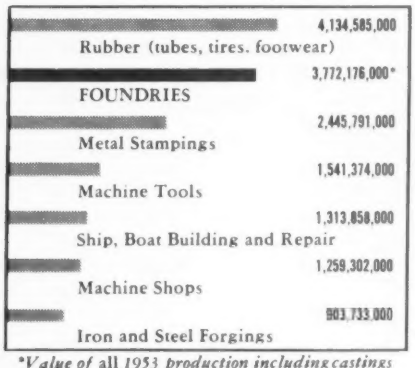
You do more business with foundries when you advertise in FOUNDRY

MARKET

Foundries spend over *$1¼ million an hour* for the materials and supplies necessary to produce an annual average of 18 million tons of castings. This adds up to over *$2½ billion* annually—does not include the estimated $35 million for plant expansion and $85 million for new equipment which the industry's 6,200 plants will invest in the next 12 months.

A GROWING MARKET

The foundry market is a part of no other market. As a basic industry it is directly related to population growth. Already 100% ahead of 1939 in physical output, the industry expects another 20% increase by 1960.

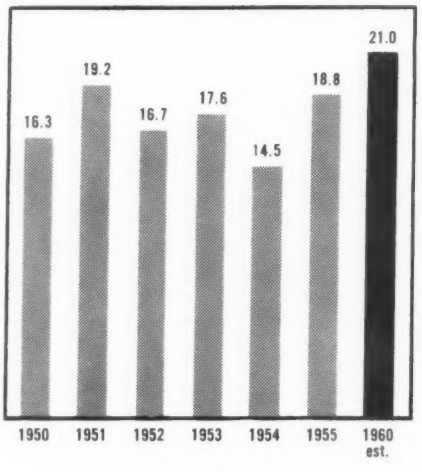


**Value of all 1953 production including castings produced by captive foundries for "own use" was $6,130,000,000.*

Foundries rank well above many allied industries commonly thought of as huge.

BIG REPLACEMENT MARKET

Foundry equipment wears out fast—is replaced fast—in this gigantic replacement market. Replacement plus the continuing trend to mechanization means *more* dollars to be divided among the manufacturers who are actively selling to the foundry industry.



As population increases, so does the need for castings. Over 90% of all durable goods manufactured require castings—as end products or as component parts. That's why the foundry industry is gearing up to produce 21 million tons of castings by 1960 — a new all-time record.

COVERAGE

Nothing covers the foundry market like FOUNDRY! It's the publication foundrymen *depend* on for latest product, equipment and method information. It's read intensely . . . brings action fast . . . among the key buying influences in all foundries in the U.S. and Canada representing 97% of the industry's melting capacity.

You reach this wealth of buying power *best* between the covers of the industry's Number 1 publication—FOUNDRY magazine.

FOUNDRY enters more PLANTS

	PLANTS	PERCENT
2500 or more employees	6	100
1000 to 2499	42	100
500 to 999	79	100
250 to 499	260	100
100 to 249	594	100
50 to 99	770	100
20 to 49	1,305	100
Less than 20	3,152	85

FOUNDRY's coverage by METALS CAST

	PLANTS	PERCENT
Gray Iron	2,729	95
Malleable	130	100
Steel	452	99
Brass and Bronze	2,723	87
Aluminum	3,355	83
Magnesium	261	85

FOUNDRY reaches more than 66,000 BUYING INFLUENCES

Through FOUNDRY your product story reaches over 66,000 key buying influences at executive, engineering, production, and purchasing levels in every worthwhile foundry in the industry—the foundries accounting for 97% of the industry's melting capacity.

Analysis of readership:

Management Personnel	12,811
Production Personnel	32,839
Process Control Personnel	8,666
Other Foundry Personnel	1,465
Government Personnel	1,085
Educational Personnel	2,920
Supplier Personnel	5,203
Castings Users and Others	1,870

FOUNDRY is the gateway to BIG business in the foundry industry. Let FOUNDRY help you capture your share of this rich, growing market. Get full details on FOUNDRY's complete Sales Development Service now.

FOUNDRY... a Penton Publication

Penton Building, Cleveland 13, Ohio

at some shops. However, there is still a fairly good over-all demand for castings for machine tools and other types of heavy equipment.

Nonferrous foundries engaged in ship propeller work continue quite busy, with backlogs far extended. Propeller work includes both new business and replacements. Shops producing pumps and large valves also are busy. Meter business is holding up well; also plumbing supplies. Nevertheless, in all cases production is affected by vacations and hot weather.

Captive shops are subletting relatively little work. This is due not only in part to the fact that business is not as heavy as it was some months ago, but also to the fact that some captive shops have enlarged their capacities within the past year or year and a half.

While aluminum shops engaged in aircraft work remain as busy as seasonal conditions will allow, those engaged in miscellaneous commercial work report a drop in demand. Especially is this so among foundries producing components for household appliances, as business in these lines has been tapering for two or three months. Pipe lines on some consumer durables have become well filled up, it is explained.

French Foundry Association Holds Annual Convention

At the annual convention of the Association Technique de Fonderie, held at Charleville, in the foundry center of the Ardennes, during the last week of May, Charles Cury, president of the association and managing director of Societe Cury et Charrier, Deville, Ardennes, was in the chair.

The following papers were presented at the technical sessions:

"Report on a Mission to the United States to Study Malleable Iron," by J. Menat of the Centre Technique des Industries de la Fonderie (C.T.I.F.).

"Investigation on the Shrinkage Tolerance in Cast Pieces," by T. Karmo and T. Uehara, Japan.

"Concerning Deformation during Cooling of Cast Pieces," by J. Leonard, consulting engineer and past president of the Belgian Foundry Technical association.

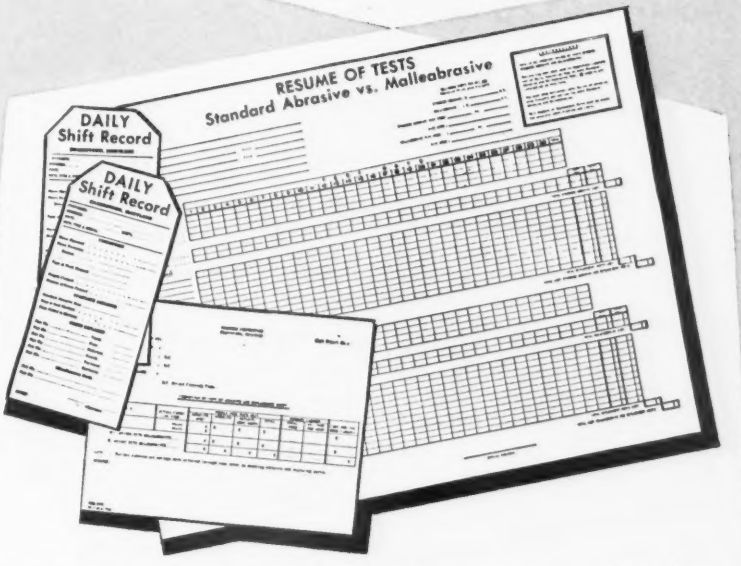
"Systematic Study of the Effects of Ramming by Squeezing," by Ch. Dennery, vice president of the association.

"Study of the Factors Influencing the Machining of Cast Iron in Heating Equipment (Ovens, etc.)," by M. Riotte, Societe Faure & Cie, Revin, Ardennes.

"Investigation on the Production of

MALLEABRASIVE®

– PUT THE "test" IN testing!



The only real test of any abrasive is its cost per ton of castings —obtained only by completely recorded use in production.

Malleabrasive was the first metal abrasive to be sold on the basis of recorded production performance in user's plants. The fact is, in its early stages of limited production, we sold it **only** to those who would agree to run recorded comparative tests. Yes, Malleabrasive really "put the test in testing" — really started all of this testing business!

Malleabrasive's economy has since been proven in hundreds of plants, so there are no restrictions on its sale any more. But— we do say, if extravagant claims and gimmick-guarantees are offered you that some other abrasives are cheaper for you than Malleabrasive, the only way to get the facts is to run recorded tests of both materials. Don't depend on generalities.

Samples of the test record forms used to establish Malleabrasive's economy will be sent on request. Write us.

THE GLOBE
STEEL ABRASIVE COMPANY
MANSFIELD, OHIO

Sold and recommended by Pangborn Corp., Hagerstown, Md.

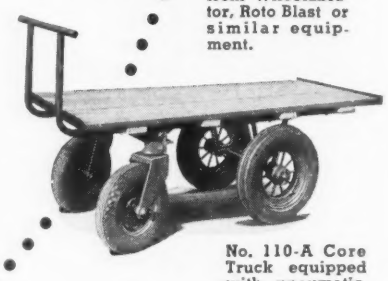
"NOW IN EASY TO HANDLE 50-POUND DOUBLE BURLAP BAGS"

TRUCKS for Foundries

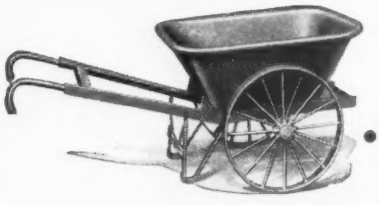
Sterling Heavy Duty Trucks are tailor-made for transporting castings, cores and heavy foundry equipment. Ruggedly constructed for heavy duty service and thoroughly job-tested under actual foundry conditions, Sterling Trucks have proven their ability to handle loads as heavy as 3 tons. Both wheels and casters are equipped with anti-friction bearings. Short turning radius. Easy maneuverability. Write for bulletins.

STERLING WHEELBARROW CO.
MILWAUKEE 14, WIS., U. S. A.

No. 160 Truck to receive castings from Wheelabrator, Roto Blast or similar equipment.



No. 110-A Core Truck equipped with pneumatic-tired wheels and ball bearing swivel casters.



No. 50 Slag Buggy especially designed for conveying slag. Heavy duty, reversible tray. Loose plate for discharge.

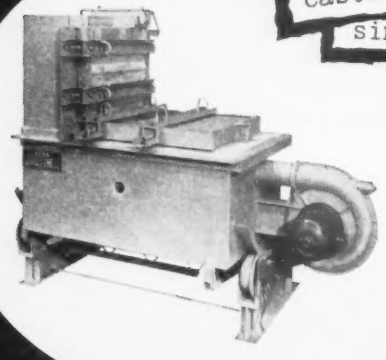
Sterling
FOUNDRY EQUIPMENT

A 5633-⅛R

Circle 653 on Inquiry Card—Page 201

Here's what Industry has to say about REDA melting Furnaces . . .

nothing but praise for the REDA FURNACE . . .
has improved overall foundry operation . . .
doing a wonderful job . . .
much more flexible . . . entirely satisfactory .
castings come cleaner . . .
sincerely recommend it . .



Reda Stack-Loading melting furnaces for ferrous and nonferrous metals have been designed and built by experienced foundrymen for foundrymen everywhere. That is why Reda furnaces provide advantages far beyond those found in other, and more expensive types; that is why, with Reda furnaces there is less down time for maintenance, l o n g e r uninterrupted melting runs, and lower melting costs.

Another feature is the Reda Burner arrangement which can operate from oil and gas simultaneously or be switched from one fuel to the other instantly. *Write or phone for complete details.*

REDA FURNACE
REDA PUMP COMPANY • BARTLESVILLE, OKLA.

Circle 654 on Inquiry Card—Page 201

Foundry Pig Iron Used for Ductile Casting," by T. Kimoshita and S. Sano, Japan.

"Treatment of Cast Iron by Bubbling Gases to Decrease the Tendency toward Hardening and Obtain High Duty Cast Irons," by G. Blanc and M. Volianik, of the Centre Technique de la Fonderie.

"Spectrophotometric Analysis of Phosphorus in Cast Iron," by L. Braicovich and F. Landi, Italy.

"Measure of the Pouring Rate of Castings," by Ch. Trenkle, S.A.C.M., Mulhouse, Ht.-Rhin.

"A Symposium on Ingot Molds," introduced by J. Durand, C.I.T.F. comprising: "Contribution to the Study of Ingot Molds before and after their Use," by M. Ferry, C.I.T.F.; "Recent Results of Tests on Ingot Molds," by G. Bauer, J. Duflot and A. Gibeau, Institut de Recherches de la Siderurgie (IRSID); "Contribution to the Study of Macrographic and Micrographic Structures of Gray Cast Iron for Ingot Molds," by L. Beaujard and Mme. S. Bechet, IRSID.

"Study of Production Methods in the Foundry. Technical Organization of a Production Cycle," by M. A. Bonneau, C.T.I.F.

"Experimental Study of Certain Factors Influencing the Rate of Solidification of Bronze Cylinders Cast in Sand," by M. Pell Walpols, Institute of British Foundrymen, Great Britain. (Exchange paper.)

"Recent Devolpments and Progress in Sandblasting Equipment," by G. Cros, Ets. Sisson-Lehmann, Charleville.

In addition to the technical program visits were organized to various foundries in the Ardennes region of the country.

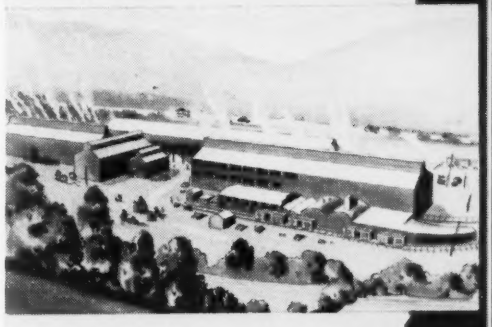
Book Review

Successful Handling of Labor Grievances, by Bertram R. Crane and Roger M. Hoffman, 307 pages, published by Central Book Co., 261 Broadway, New York 7. Price $5.95.

From a background of legal and industrial experience in labor relations, the authors have compiled a volume that deals with day-to-day administration of grievance contracts. Practical know-how in handling labor-management problems, from the point of view of management, the foreman, and the shop steward, is given.

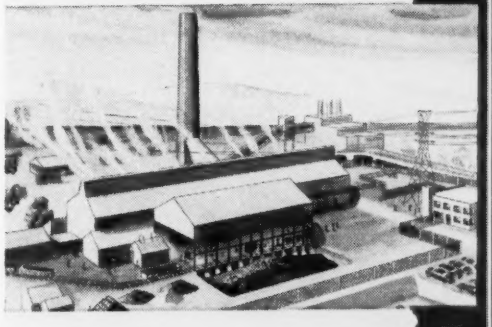
Some suggested grievance codes, originated by the authors, and many grievance forms used by leading corporations, are described. With the view to help labor and management settle their differences without intervention of third parties, the book suggests means to more harmonious relationships.

PHILO, OHIO



TACOMA, WASH.

BRILLIANT, OHIO



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- SPECIAL BLOCKING 50% FERRO-SILICON
- SILICON METAL
- HIGH CARBON FERRO-CHROME
- LOW CARBON FERRO-CHROME
- LOW CARBON FERRO-CHROME SILICON
- FERRO-MANGANESE
- SILICO-MANGANESE
- MEDIUM CARBON FERRO-MANGANESE
- BOROSIL
- SIMANAL
- RARE EARTH ALLOYS

Briquets

- SILICON
- MANGANESE
- CHROME
- SILICO-MANGANESE

Here's the Key...

. . . To friendly service and a personal interest in your Ferro-Alloy requirements. You who know us have turned this key many times. It has been and will continue to be our pleasure to serve you.

To you who have never used this key, we say "welcome". We think you'll like our way of doing business. You will find it's your way too.

Ohio Ferro-Alloys Corporation
Canton, Ohio

Chicago Detroit Pittsburgh Tacoma Seattle Denver
Minneapolis Birmingham San Francisco Los Angeles

Foundry Developments

By EDWIN BREMER
Metallurgical Editor

FOUR castings for artillery components—including a high-pressure cylinder head for the 120-mm gun, a top cover and bottom cover assembly, and a block manifold for the 280-mm gun—were cast experimentally at Watertown Arsenal, and were proved sound by sectioning and other tests. After obtaining the best techniques for sound castings, the components were recast and subjected to heat treatment prior to chemical and physical testing. It was determined that casting of these items instead of forging them is feasible. Details are described in "Development of Steel Castings for Artillery Components" by C. F. Frey and designated PB 111967. Report may be secured from Office of Technical Services, Department of Commerce, Washington 25, for 75 cents.

Tests Sands

ONE foundry using a blowing machine for mold production conducts tests on the "blowability" characteristics of sand mixes on a small cartridge-type core blower, using a ½-in. blow hole. Effects of moisture content, additives, bond as well as blow pressure can be determined.

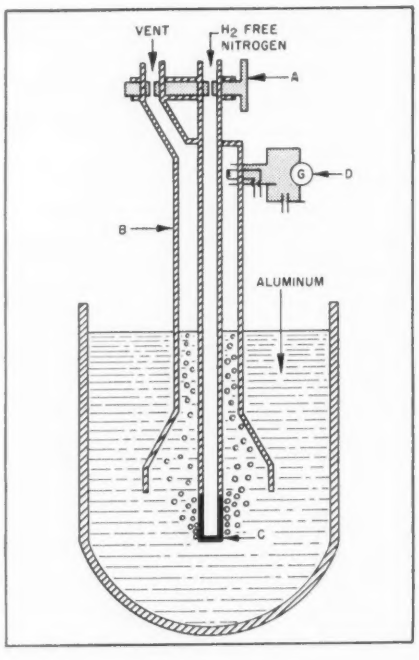
Rapid Analytical Procedure

ELECTROLYTIC procedure for precise determination of very small amounts of impurities in zinc and zinc-base alloys has been developed by the National Bureau of Standards, Washington. Procedure does not require preliminary chemical separations, is relatively fast and requires little operative attention. Developed by J. K. Taylor and S. W. Smith, the method is to dissolve the sample in an electrolyte and place in an electrolytic cell with a mercury-pool cathode. Anode is a platinum gauze cylinder. Solution is electrolyzed at a potential which allows the zinc to remain in the electrolyte but withdraws Cu, Sn, PB and Cd into the mercury pool.

When electrolysis is complete, the residual zinc solution is discarded and replaced by a fresh electrolyte. Electrolysis then is resumed at a lower potential chosen to redissolve the trace elements singly or collectively from the mercury. Solutions obtained are analyzed polarographically with no interference with Zn. Technical details of the method are given in "Polarographic Determination of Lead and Cadmium in Zinc-base Alloys Using Electrolytic Separations at Controlled Potential" by J. K. Taylor and S. W. Smith, *Journal of Research,* National Bureau of Standards, 55,301 (1956), RP 2679.

Hydrogen in Aluminum

LAST month in this department mention was made of a procedure for rapidly and easily determining the amount of hydrogen in molten aluminum, a process developed by Dr. Ransley. The accompanying illustration schematically shows the instrument used. It consists of a vented collector housing *B* containing a tube for introducing the hydrogen-free nitrogen. The lower portion of the tube is porous, as indicated at *C*, so that the gas stream is admitted in the form of fine bubbles. Procedure is to open valve *A* so that the nitrogen evolves at a slow rate, and then the collector is immersed in the aluminum to a given depth. After a short period to remove all the air and fill the collector with nitrogen, the valve is closed. Conductivity of the mixed gas, determined by meter *D*, indicates hydrogen content in percentage or in ml per gram of aluminum. The process is patented.



Gas Turbine Material

COMPARATIVELY new vacuum-melted nickel-base alloy M-252 is proving suitable for extended operation under load at temperature of 1240°F, according to engineers at General Electric's Metallurgical Products Department, Detroit. The alloy is reported to exhibit high rupture strength, good fatigue strength and high resistance to thermal shock. The material now is being used in the form of forged buckets in four 7600-hp gas turbines operated at 1240°F and 6900 rpm. It also is being applied in 12 other turbines, two of 16,000-kw for power generation and five each of 5000-hp and 7600-hp for pipeline pumping.

Brass Die Casting

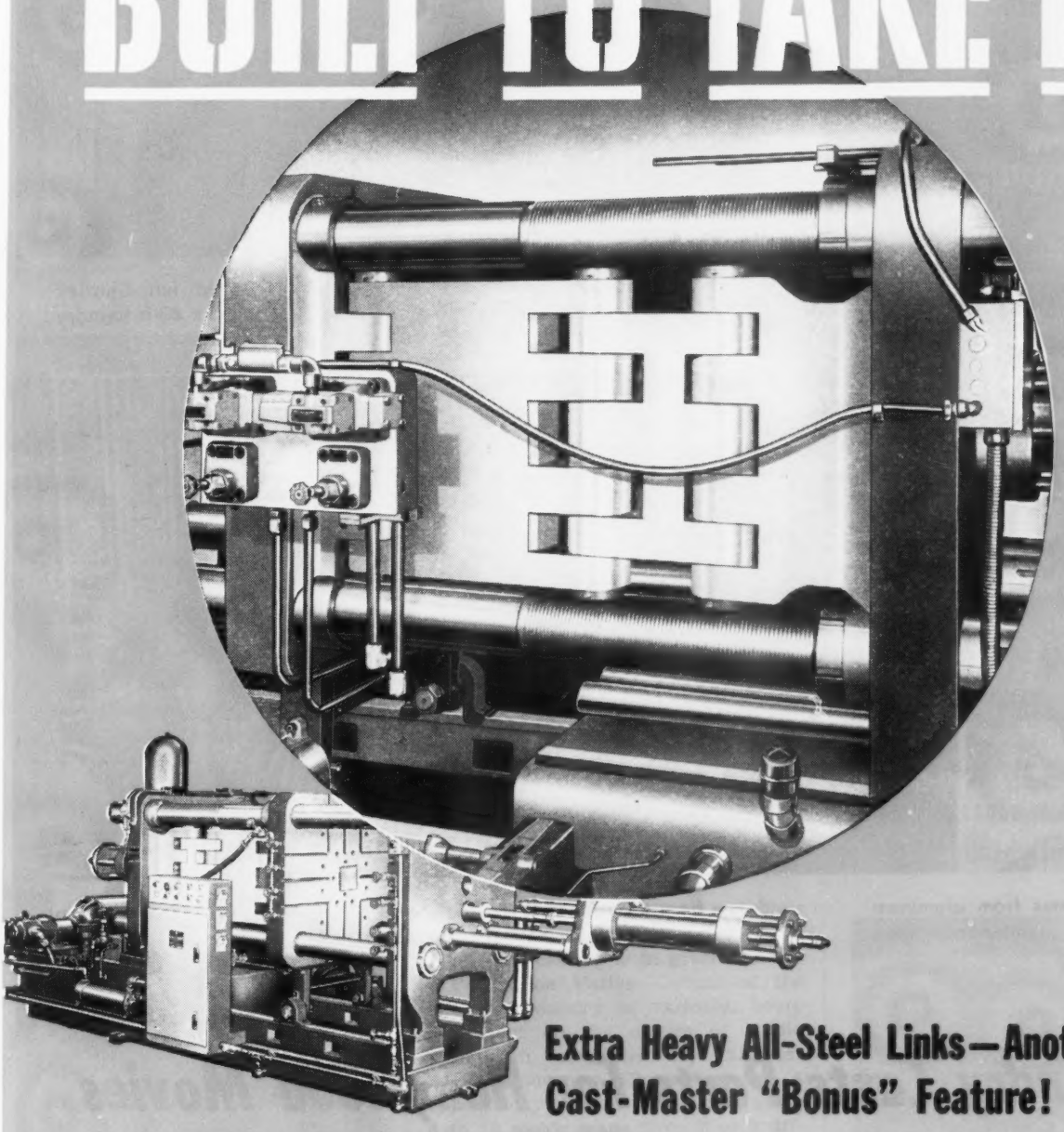
INDICATIONS are that the greatest deterrent to the more widespread application of pressure die-casting brass—lack of suitable die steels—is being overcome, and before long materials possessing the desired properties will be available.

Boron Improves Properties

INFLUENCE of boron, alone or with titanium, on the high-temperature strength of a 13 Cr-15 Ni-2 Mo-Fe alloy is discussed in a study for the Air Force just released by the Office of Technical Services, Department of Commerce, Washington 25. It was found that boron was very effective in increasing creep-rupture strength at 1200°F, but far less was required in the presence of 0.6 per cent Ti.

Response to hot-cold work as measured by creep-rupture strength at 1200°F was increased by boron, but again lesser amounts were required in presence of Ti. Strengths were the same in both cases. Boron additions appreciably increased elongation and reduction of area in creep-rupture tests. Complete details are presented in report PB 121101, "Investigation of the Influence of Boron and Titanium on the High-Temperature Properties of Cr-Ni-Mo-Fe Austenitic Alloys," by C. L. Corey and J. W. Freeman. Price is $2.

BUILT TO TAKE IT



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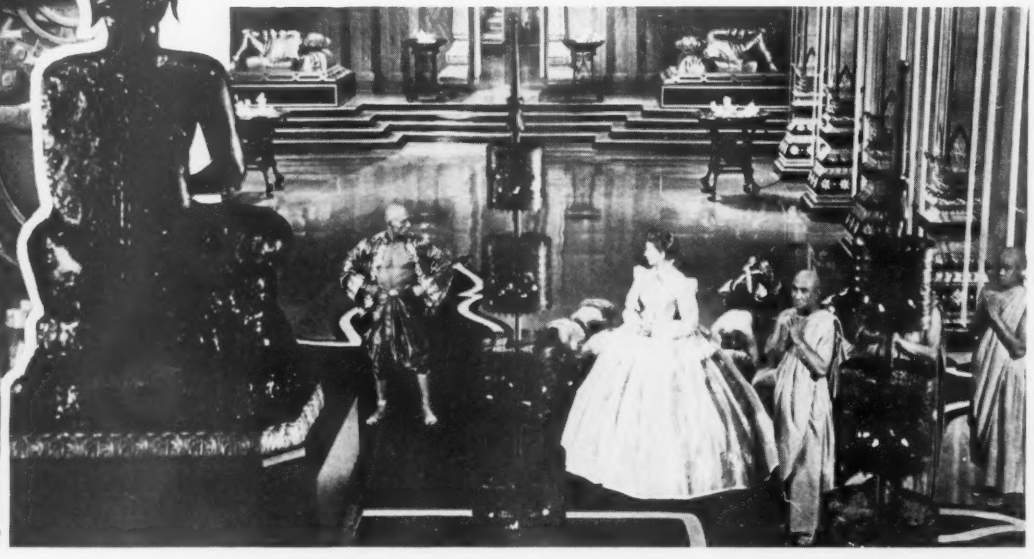
Removing gates from aluminum casting for maintenance crew

With temporary assistance of tinsmith Bert Rosenfeld, left, Charley Kirchhan pours a casting in a green sand mold in 25 x 40-ft foundry



Scene from the recently released movie "The King and I" shows oriental statuary, lamp components and torches made in 20th Century Fox foundry

Foundry Casts Parts For Hollywood Movies

By THOMAS A. DICKINSON

IMAGINE, if you can, a foundry with a 25 x 40-ft floor which continuously sand casts such varied materials as yellow brass, bronze, aluminum 108 and 356 alloys, nickel, lead and iron.

That is precisely the sort of foundry Charley Kirchhan operates for Twentieth Century Fox Studios at Beverly Hills, Calif. And Charley, who has held his present job for two years, thinks he has a pretty soft touch—especially when he recalls a similar foundry which he operated for 12 years at Metro-Goldwyn-Mayer Studios in Culver City, Calif.

It's not a matter of one foundry being better equipped than the other, he says; it just so happens that at Twentieth Century Fox he sometimes gets technical advice and assistance from such fellows as Tom Smyth, foreman of the studio's electric machine shop, and Bert Rosenfeld, Smyth's tinsmith. That's important, it seems, because most studio foundrymen must rely strictly on their own physical and mental resources.

Props and Maintenance—In addition to special props for motion picture sound stages, Charley's castings include such things as replacement parts used by studio maintenance personnel and a variety of camera components. Most of these items require no close dimensions, but the camera components must usually have as-cast tolerances of $\pm 1/64$-in.

Wood patterns for precision castings are made in the studios' pattern shop, which has specially-trained personnel for the fabrication of such articles. Nonprecision foundry patterns are made by Charley—usually from plaster and clay.

Charley uses clay in making patterns when he's in a hurry, and on several occasions when he was in a particular rush he has formed molds

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without delaying to make patterns.

Molds for nonferrous castings are currently being made from SWS sand, which is comparable to Windsor Lock sand. Coarser materials are used in making ferrous castings, and Charley does all ramming with manual tools in more or less conventional wood and metal flasks.

A small gas-fired oven is used in baking cores, which are also made by Charley.

Special Furnaces — Metals are melted in a pair of furnaces, one of which can hold up to 60 lb of aluminum while the other can retain up to 125 lb of iron. Both furnaces are subfloor units made to order for Twentieth Century Fox, because conventional furnaces would produce vibrations that could interfere with camera operations on nearby sound stages. Each is gas-fired and has a double liner to create an air space which dampens vibrations.

Like most foundries using brass in the Los Angeles area, studio foundries have had their troubles with officials responsible for the local control of air pollution. However, Charley says he has been able to avoid such difficulties at Twentieth Century Fox without using special smoke-precipitation equipment.

"I put a small quantity of ordinary copper wire on top of the brass," he explains. "Because copper has a relatively low melting temperature, I then get a molten material for the absorption of fumes while the brass is melting. Glass in the melting pot floats to the surface and prevents air pollution in the usual way when the brass itself is molten."

About 90 per cent of the materials now being cast is obtained from scrap. All casting is in green sand.

Production Varies—Output of the one-man foundry is variable, being dependent on the nature of studio production activities at different times. However, Charley claims a typical day's work finds him using 8 to 18 molds made from 2 or 3 different patterns.

On his busiest day, about a year ago, Charley estimates he cast 400 lb of metal.

The largest casting he has yet made was a 5-ft high replica of a submarine door, cast of aluminum. Smallest were 2-oz brass parts for miniature racing cars, which were needed to make auto-race shots by means of trick photography.

Run - of - the - mill castings in Charley's book are medieval swords and battle axes for motion picture knights, spears for actors with cannibal roles, and gas-fired torches for oriental stage settings.

Virtually all of the iron castings being made at this writing are preci-

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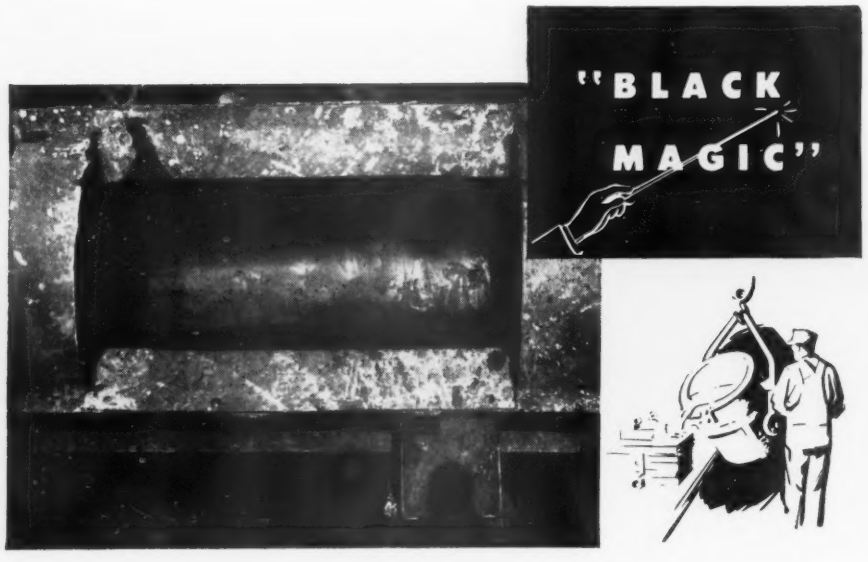
sion camera parts. Stage props are commonly made from lead and brass, the latter being preferred where yellowish hues are essential to realistic sets for color pictures. Aluminum is ordinarily used in casting such things as replicas of antique guns and costume components, whose weight might be a handicap for actors, and more expensive materials like the 70-30 nickel alloy are employed in making maintenance items requiring high corrosion resistance, optimum mechanical strength, etc.

Book Review

Metal Statistics, 1956, cloth, 844 pages, 4 x 6 in., published by American Metal Market, 18 Cliff St., New York 7. Price $3.50.

The 49th annual edition of Metal Statistics, 1956, contains up-to-date as well as historical data of production, consumption, stocks, imports and exports, monthly and annual market prices and other statistics of reference value for the iron, steel and metal industries. A buyer's directory is included.



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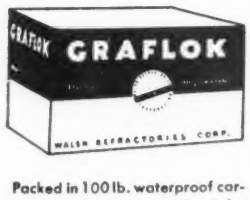

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Castings Specifications Are Reviewed by ASTM

Meeting Program Attracts Near-Record Attendance

By EDWIN BREMER
Metallurgical Editor

PRACTICALLY a record-breaking attendance marked the 59th annual meeting of the American Society for Testing Materials held at Chalfonte-Haddon Hall, Atlantic City, N. J., June 17-22. In addition to 32 technical sessions, and several hundred committee meetings, the program included an exhibit of testing and scientific apparatus and laboratory supplies.

At the president's luncheon, honorary memberships in the society were presented to four members who over long periods contributed greatly to the advancement of the organization's work. Recipients included James T. MacKenzie, Southern Research Institute, Birmingham, and Albert E. White, Ann Arbor, Mich. In recognition of distinguished service along technical lines, Awards of Merit were made to 11 members, including Vincent T. Malcolm, Chapman Valve Mfg. Co., Indian Orchard, Mass.; William L. Fink, Aluminum Research Laboratories, Aluminum Co. of America, New Kensington, Pa., and Bruce W. Gonser, Battelle Memorial Institute, Columbus, O.

American Steel Foundries, Chicago, was recognized as a 50-year member of the society, and 40-year recognition was accorded to American Chain & Cable Co., Bridgeport, Conn.; American Manganese Bronze Co., Holmesburg, Philadelphia; Canadian General Electric Co. Ltd., Toronto, Ont.; Continental Foundry & Machine Div., East Chicago, Ind. and Consolidated Mining & Smelting Co. of Canada, Trail, B. C.

Newly elected officers and directors of the society were presented. They included: President, Rudolph A. Schatzel, Rome Cable Corp., Rome, N. Y.; vice president, Kenneth B. Woods, Purdue University, Lafayette, Ind.; directors, Miles N. Clair, Thompson & Lichtener Co. Inc., Brookline, Mass. Howard C. Cross, Battelle Memorial Institute, Columbus, O., R. R. Litehiser, Ohio State Highway Testing Laboratory, Columbus, O., and Charles R. Stock, American Cyanimid Co., Stamford, Conn.

Attention was directed to the West Coast national meeting to be held at the Statler Hotel, Los An-

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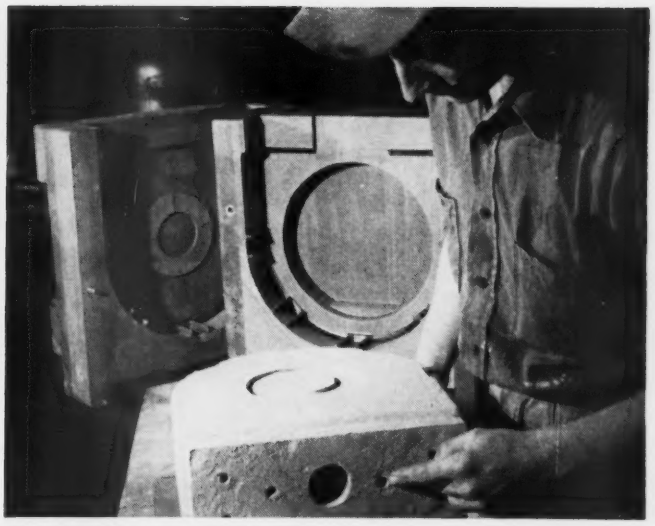

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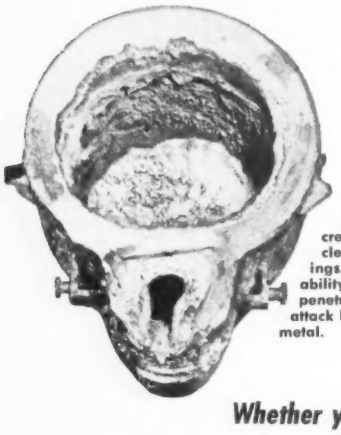

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geles, Sept. 16-22. It was announced that the 1957 Committee Week will be held at the Benjamin Franklin Hotel, Philadelphia, Feb. 4-8, and the 1957 annual meeting at Chalfonte-Haddon Hall, Atlantic City, N. J., June 16-21.

Steel Specifications—In the report of Committee A-1 on Steel, revisions were recommended in three steel castings, specifications and withdrawal of one. The latter is Standard Specifications for Carbon-Steel Castings for Valves, Flanges and Fittings for High Temperature Service (A 95-44). Withdrawal was recommended because most of the material is purchased in accordance with Tentative Specification A 216.

Revisions recommended included: In Tentative Specifications for Carbon-Steel Castings Suitable for Fusion Welding for High-Temperature Service (A 216-53T), a decrease in maximum carbon content from 0.35 to 0.30 per cent, and an increase in maximum manganese from 0.70 to 1.00 per cent of Grade WCB. Hydrostatic testing requirements for the alloy also were changed.

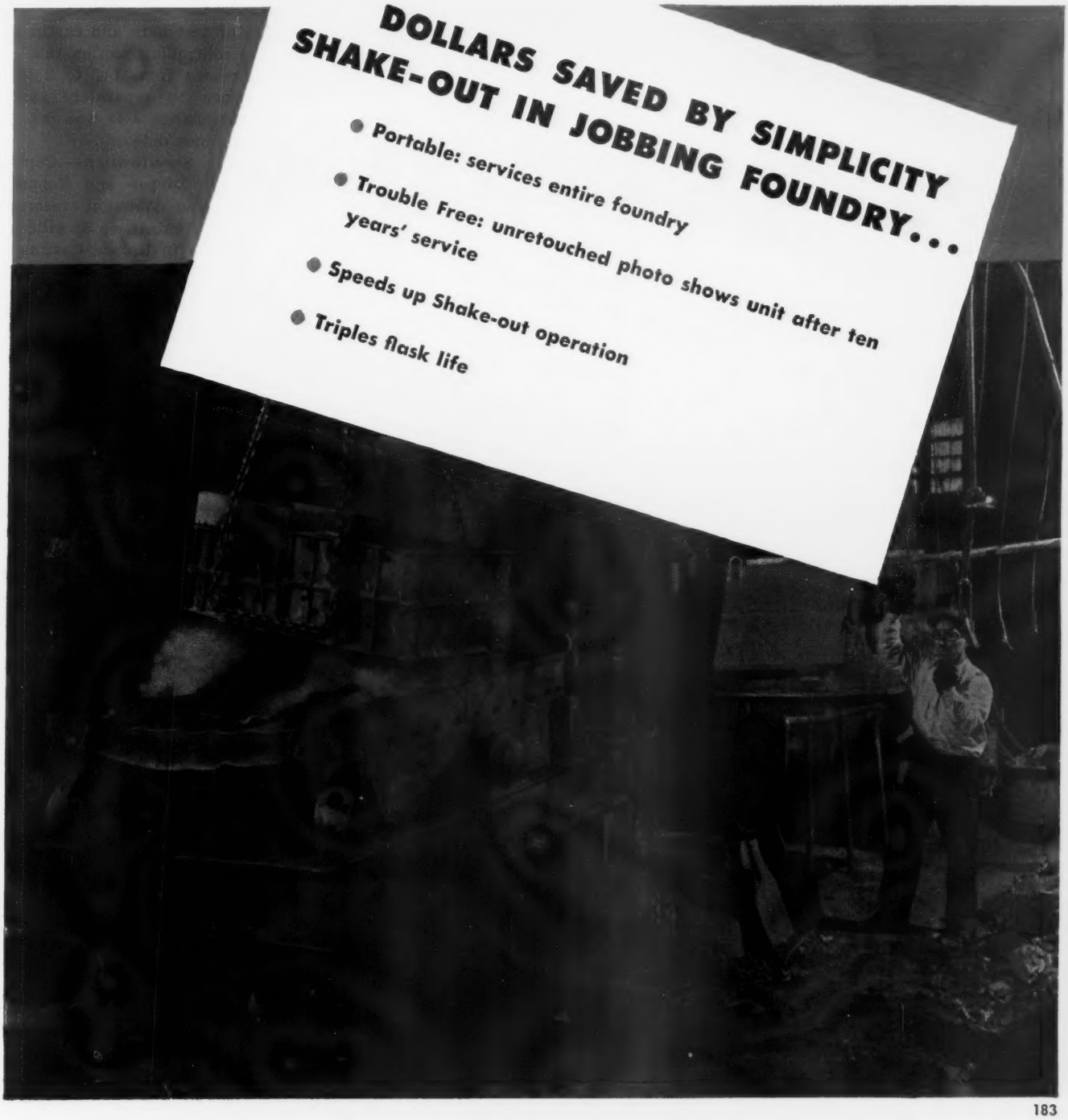
In Tentative Specifications for Heavy-Walled Carbon and Low Alloy Steel Castings for Steam Turbines (A 356-52T) chromium range for Grade 10 alloy was changed from the present 2.00 to 2.50 per cent to 2.00 to 2.75 per cent.

Tentative Specifications for Alloy Steel Castings Normalized and Drawn for High Pressure and Elevated Temperature Service (A 389-55T) now is titled Alloy Steel Castings Specially Heat Treated for Pressure Containing Parts Suitable for High-Temperature Service. Revisions were recommended in the scope, heat treatment and chromium content of Grade C24. Cr content was changed from 0.80-1.20 per cent to 0.80-1.25 per cent.

Cast Iron Revisions—Committee A-3 on Cast Iron recommended revisions in three specifications. In Tentative Specifications for Cast Nodular Iron for Pressure Containing Parts for Use at Elevated Temperatures (A 395-55T), a change was made with reference to the plugs employed in repair, making it more specific.

A new class, No. 45, was added to Standard Specification for Gray Iron Castings (A48-48). This grade has a minimum tensile strength of 45,000 psi, and transverse test requirements are included.

In Standard Specifications for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 F (A 278-53), changes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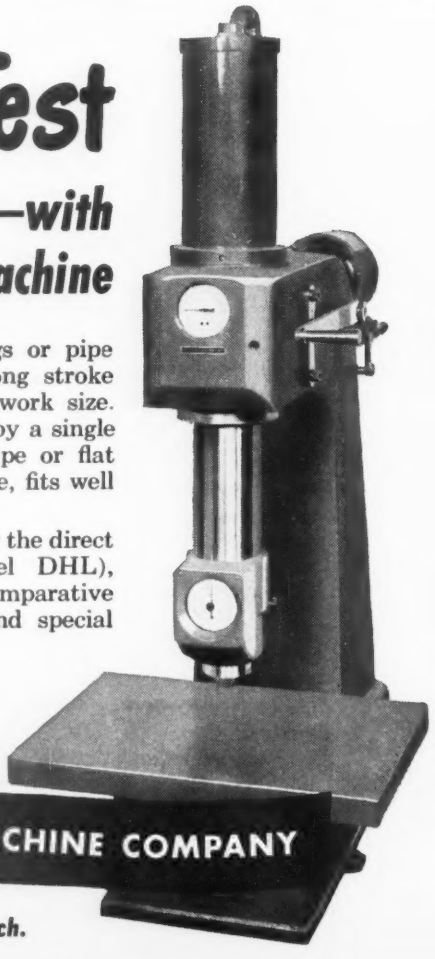

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were made in the section relating to correlation of test bars and castings in that the controlling section thickness is increased from 1½ to 2 in. with reference to separately cast test bars. A change also was made in repair of minor defects.

Nonferrous Specifications—Committee B-5 on Copper and Copper Alloys, Cast and Wrought recommended that Tentative Specifications for Nickel-Tin Bronze Castings (B 292-54T) be adopted as standard without revision.

Committee B-6 on Die-Cast Metals and Alloys suggested revisions in two tentatives. In Tentative Specifications for Aluminum-Base Alloys for Die Castings (B 85-54T) a new section pertaining to an appendix also newly added is included. The appendix comprises a table giving melting range and characteristics of the various aluminum alloys used for die casting.

In Tentative Specification for Zinc-Base Alloy Die Castings (B 86-53T) an explanatory note is added to the table on chemical requirements pointing out that usual small amounts of Ni, Cr, Si, and Mn have no harmful effect, and quantitative analyses are not required.

Recommends Many Revisions

Committee B-7 on Light Metals and Alloys, Cast and Wrought recommended numerous revisions in five tentatives and one standard specification. In Tentative Specification for Aluminum-Base Alloy Sand Castings (B 26-55T) changes were made in some of the chemical composition limits.

In Tentative Specifications for Magnesium-Base Alloy Sand Castings (B 80-55T), a number of changes were recommended including the withdrawal of alloys AM80A and M1B and the addition of four new alloys, namely HK31A, HZ32A, ZE41A, and ZH62A. Alloy HK31A contains 2.5 to 4.0 Th and 0.40 to 1.0 Zr. HZ32A contains 1.7 to 2.5 Zn, 2.5 to 4.0 Th, 0.10 max rare earths, and 0.15 min Zr. ZE41A contains 3.5 to 5.0 Zn, 0.75 to 1.75 rare earths, and 0.40 to 1.0 Zr. Alloy ZH62A contains 5.2 to 6.2 Zn, 1.4 to 2.2 Th and 0.50 min Zr. Descriptions of the new alloys with tensile requirements are included.

Some slight changes in chemical composition were recommended in Tentative Specifications for Magnesium-Base Alloys in Ingot Form for Sand Castings, Die Castings and Permanent Mold Castings (B 93-55T).

In Tentative Specifications for Aluminum-Base Alloy Permanent

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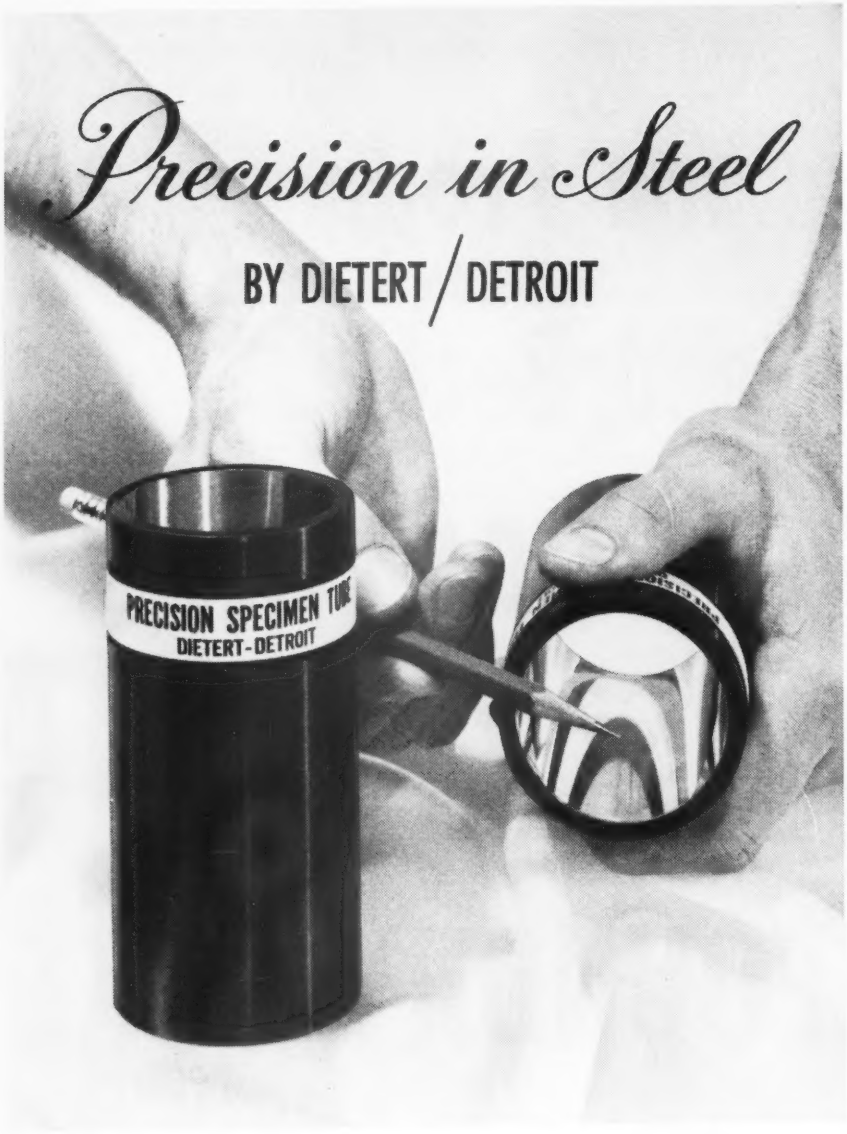


This is a Dietert-Detroit Precision Sand Specimen Tube used by leading foundries everywhere to form the AFS standard 2 inch diameter by 2 inch high sand test specimen.

To insure dependable and reliable test data from the specimen, the following operations are performed on a section of seamless, hard, tough Nitraloy steel to produce a Dietert-Detroit Sand Specimen tube.

Cut off, face and
rough bore to 1.940 inch
Normalize
Bore to 1.994 inch I.D.
Heat treat
Centerless grind O.D.
Oxidize
Hone to 2.000 ± .0005 inch
Finish to 3 to 6
micro inches R.M.S.

This specimen tube is but one of many tools available to foundrymen from Dietert-Detroit, specifically designed to improve casting quality, reduce scrap and increase output. It is a well established fact that an effective sand control program is one of the most effective methods of improving foundry output!

Write for sand testing and control catalog today!

DIETERT DETROIT

HARRY W. DIETERT CO.
9330 Roselawn Avenue
Detroit 4, Michigan

Circle 666 on Inquiry Card—Page 201

Mold Castings (B 108-55T), in addition to slight changes in chemical limits for two of the alloys, a new one SC103A was added. It contains 2.0 to 4.0 Cu, 1.2 Fe, 8.5 to 10.5 Si, 0.50 Mn, 0.50 to 1.5 Mg, 1.0 Zn, 0.25 Ti, and 0.50 Ni.

In Tentative Specifications for Magnesium-Base Alloy Permanent Mold Castings (B 199-55T), some revisions were made in various sections for amplification and clarification.

Some changes in chemical limitations were made in Standard Specifications for Aluminum-Base Alloys in Ingot Form for Sand Castings, Die Castings and Permanent Mold Castings (B 179-55). In addition, alloy ZC81A-B was deleted and replaced with two alloys ZC81A and ZC81B. These alloys contain 7 to 8 Zn, with ZC81A limited to 0.8 Fe and ZC81B to 1.0 Fe. Two new alloys SC103A and SC114A were added. SC103A shows 2.0 to 4.0 Cu, 1.0 Fe, 8.5 to 10.5 Si, 0.50 Mn, 0.6 to 1.5 Mg, and 1.0 Zn. Alloy SC114A contains 3.0 to 4.5 Cu, 1.0 Fe, 10.5 to 12.0 Si, 0.50 Mn, 0.10 Mg, and 0.9 Zn.

Recommends No Revision

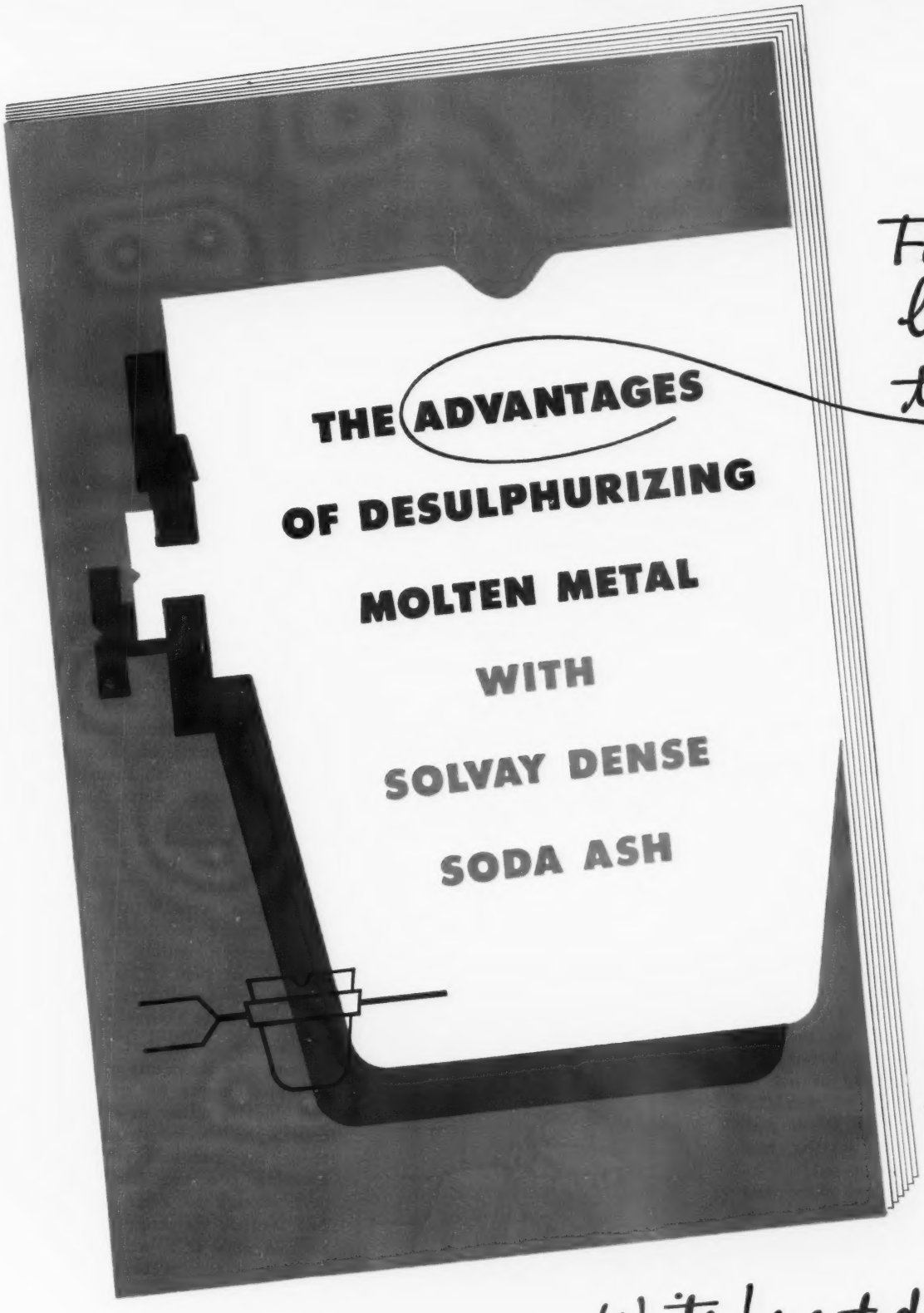
Committee A-9 on Ferro-Alloys recommended that the Tentative Specifications for Ferromanganese (A 99-53T) be adopted without revision as a standard.

Committee E-3 on Chemical Analysis of Metals recommended for adoption as standard, tentative photometric methods for aluminum and aluminum-base alloys (E 34-54T), magnesium and magnesium-base alloys (E 35-50T), and copper and copper-base alloys (E 62-50T).

Proposed revised tentative methods for addition to Chemical Analysis of Steel, Cast Iron, Open Hearth Iron and Wrought Iron (E 30-52) include photometric methods for manganese, nickel, columbium and tantalum, and the mercury cathode method for magnesium.

A paper presented at one of the sessions, "Fatigue Properties of Comparable Cast and Wrought Steels," by E. B. Evans and L. J. Ebert, Case Institute of Technology, and C. W. Briggs, Steel Founders' Society of America, Cleveland, indicated that unnotched endurance limit of any one of the cast steels was about four-fifths that of the corresponding wrought steel.

With introduction of a notch, the endurance limit for both cast and wrought material was affected significantly, with the cast steel exhibiting a greater notch resistance. With a lathe-turned finish, endurance limit of cast steel remained about the same as with a polished finish, but the comparable wrought steel suffered a pronounced decrease in its endurance.



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Circle 667 on Inquiry Card—Page 201

Man to Man

By RALPH L. LEE

"The biggest single factor in the success or failure of an organization is in the margin between the least the boys in the plant can get by with and what they can do if they feel like doing it"

QUITE some time back, a rather scowly looking individual drew me to one side at a foundry meeting where I had spoken and said, "Doc! I'm a man of few words. I call a spade a spade. Frankly some of the Man-To-Man stuff you've been handing out struck me as pretty much hooey."

"But," I started to interrupt.

"Hold your horses till I get through," he replied. "For some cockeyed reason we suddenly get cold iron out at our foundry. I call in everyone responsible and lay down the law, but nothing happens. We still get cold iron. After blowing my top again and just about ready to try anything, I remember something you'd written.

"It reminded me that for quite a stretch the only time the boys out in the shop had heard from me was when something went haywire. Those who were carrying the load and staying out of trouble never heard a peep out of me.

"So with my fingers crossed," he went on, "I thought I'd try something. 'Shorty!' " I said to one of the men I'd bawled out for the cold iron. "I never did get around to thanking you for getting us out of that mess we were in on that Oblinski job." These kind words just about floored Shorty, leaving him speechless.

"With this good deed done and in sort of a Boy Scout mood, I made the rounds of those I'd neglected to thank for the extras they'd done beyond what was expected of them during the past month, even those who had nothing to do with cold iron. I didn't salve any of them, just gave them their just dues.

"Well sir! Doc, the iron got hot right away, and I'd be willing to bet that none of them had been holding out on me for spite. Now don't get cocky, Doc, you hadn't told me one darned thing I didn't know already. I was just too much wrapped up in meeting my own schedule to thank those who were doing the most to help me do it."

It's a Common Failing—I don't think my plain-spoken Spade Caller was a stinker by any means; in fact, he falls within a sizable group of all too human supervisors who aren't quite on top of their jobs. These bosses find that practically all of their time is taken up with giving orders and jacking up those who fall behind, with little or no time left for thanking those who do more than their share.

Time and again I have pried apart an almost impossible speaking schedule to help out some hard-pressed program chairman, who, after I committed myself, dropped me like a hot potato. Knowing that his skin was saved and that I'd keep my word by hook or crook, he made no attempt to contact me at the meeting, didn't show up himself and forgot to send me a note of thanks.

I'm afraid that some employers, without thinking the thing through, are under the impression that the pay check settles all of their obligations to those they have hired to help them make a success of their own personal jobs. Yet we all know that a foundry manned entirely by clock-watchers would have a pretty tough row to hoe.

We all know that a foundry manned entirely by clock-watchers would have a pretty tough row to hoe

Something More Than Pay—When you stop to think of it, it would be a tough job to find enough pure, unadulterated clock watchers, working only for pay, to man even the smallest outfit. Most people, knowing they've got to work to pay their bills, like to get their minds off the compulsory angle of their jobs by trying to distinguish themselves one way or another. Some do it by always being on the job (and that's not to be sneezed at), some by always being on time and ahead of schedule, some by developing unusual skills, some with the knack of licking tough problems, of keeping their temper, willing to co-operate and full of pep. This is the way people are—in different proportions and degrees, of course.

It seems to me that any manager or boss who takes any or all of these accomplishments for granted as his just dues is either in serious career trouble or headed definitely for it. Even the personal satisfaction of knowing you are doing your best isn't enough to keep you going at full throttle for long; you've got to be told once in a while, you've got to have a receipt besides that contained in the pay envelope.

The Thank You Helps—In the midst of this great surge of labor-reducing automation, labor statistics and mass contractural relationships, it wouldn't hurt a bit to remember that the biggest single factor in the success or failure of an organization lies in the margin between the least the boys in the plant can get by with according to contract and what they can do if they feel like doing it. Hon-

CRUCIBLE FURNACES melt all the metal

in this well known Eastern Foundry

Seven forced draft coke fired Crucible furnaces. No. 225 and No. 300 Crucibles are used according to quantity of metal desired.

THE PHILADELPHIA BRONZE AND BRASS CORPORATION

PRODUCER of non-ferrous castings, maintains uniform quality and meets specifications by using only Crucible melted metals.

MELTING EQUIPMENT consists of seven stationary coke fired furnaces (illustrated) each of 900 pounds capacity; three tilting Crucible furnaces (illustrated) oil fired, each 1200 pounds capacity and four stationary oil fired furnaces (not illustrated) 450 pounds capacity each.

CRUCIBLE FURNACES here, as in some 3000 other non-ferrous foundries in the United States, demonstrate their superiority in economy, flexibility and adaptability in the production of sound castings with minimum rejections.

Three tilting Crucible furnaces oil fired, using No. 430 long lipped Crucibles, 1200 pounds capacity each.

No. 300 Crucibles, 900 pounds capacity, are lifted from the stationary coke fired furnaces carried directly to the molds and poured.

CRUCIBLE MANUFACTURERS ASSOCIATION

11 W. 42nd Street New York 36, N. Y.

Ross-Tacony Crucible Co.

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Joseph Dixon Crucible Co.

Lava Crucible-Refractories Co.

American Refractories & Crucible Corp.

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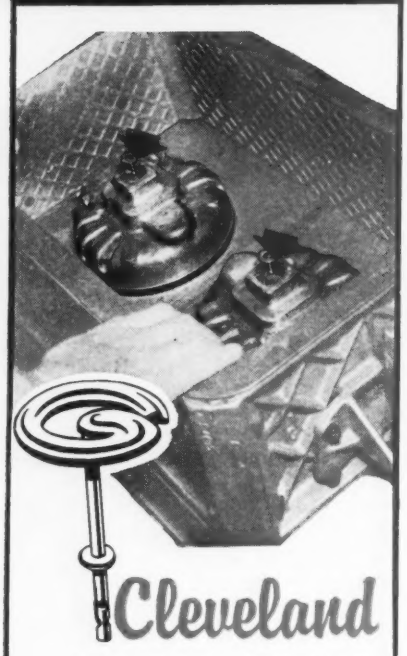
Circle 668 on Inquiry Card—Page 201

TAYLOR & BOGGIS

USES 18% LESS SAND
SAVES LABOR WITH...



Cleveland
FLAT COIL
CHAPLETS

Note clean chaplet breakoff on end bell hub which reduces cleaning operations.

Due to their low cost, Taylor & Boggis also uses flat coil chaplets for soldiers in deep green sand core pockets.

Only 1/2" to 1" of sand cover is required in the cope for firm support of these end bell core chaplets. Flasks are lighter and 18% less sand is handled on the end bell mold line.

In addition to providing positive core support, Cleveland Flat Coil Chaplets speed molding at Taylor & Boggis due to uniform stems and plating thickness. Check today for details on flat coil chaplet advantages in your molding lines.

Write today for *sample* and catalog!

Cleveland Since 1890
CHAPLET & MFG. CO.
26471 LAKELAND CLEVELAND 32, OHIO

Circle 669 on Inquiry Card—Page 201

est and sincere thanks given personally on a Man-To-Man basis—when due and on time—is one of the best ways I know of developing this highly profitable feeling. And it's a decent thing to do, anyway.

Plant Layout and Facilities Planning Subject of Course

A five-day course on plant layout and facilities planning will be conducted by the University of Kansas, Sept. 4-8. It is intended to assist the company facing expansion, consolidation or decentralization of its facilities, the planning of a new plant or the relayout of an existing plant.

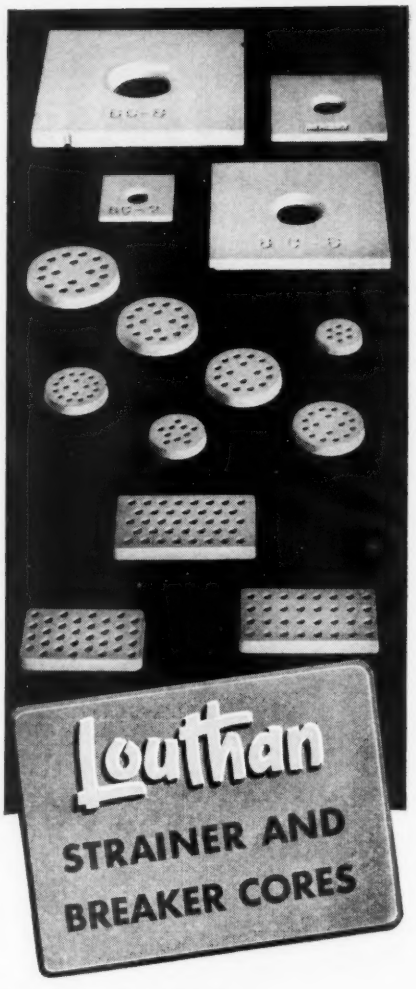
Conducted by top specialists, the course will feature a clinic-conference each evening on specific problems facing the plant of each enrollee. Inquiries may be addressed to Midwest Work Course on Plant Layout & Facilities Planning, 4112 Eaton St., Kansas City 3, Kan.

Book Review

ASTM Standards, Part 5, Fuels, Petroleum, Aromatic Hydrocarbons, Engine Antifreezes, cloth, 1458 pages, 6 x 9 in., published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3. Price $11.

This volume contains over 240 formally adopted standards, tentative specifications, methods of test and definitions relating to the various materials indicated in the title. Book is divided into eight subdivisions covering petroleum products and lubricants; ASTM engine test methods for rating fuels; methods for measuring and sampling petroleum and petroleum products; coal and coke; gaseous fuels; industrial aromatic hydrocarbons; engine antifreezes, and thermometers and general testing methods.

"So what! It's a little large—think of the added protection it gives you—"



For closer control of molten metal

Louthan Refractory Strainer Cores will not chip, spall or erode, even at temperatures as high as 3,000° F. Dimensionally accurate, they give you uniform casting rates. They keep slag and core-sand inclusions out of castings—save you needless grinding and rejects. Try them! Complete range of standard sizes. Special sizes to order.

Louthan Refractory Breaker Core Shapes generate no core gas when exposed to heat of molten metal. They are smooth, strong, resist breakage. Try them! Complete range of standard sizes. Special sizes to order.

WRITE TODAY FOR *FREE* CORE PRINTS!

Test Louthan Strainer Cores in your own plant—prove to yourself that they save money, help produce better castings. We'll be happy to send you FREE core prints for your patterns, also a test-quantity of strainer cores. Simply tell us your sprue diameter (or in-gate size). Why not write us today?

The Louthan
Manufacturing Company EAST LIVERPOOL, O.

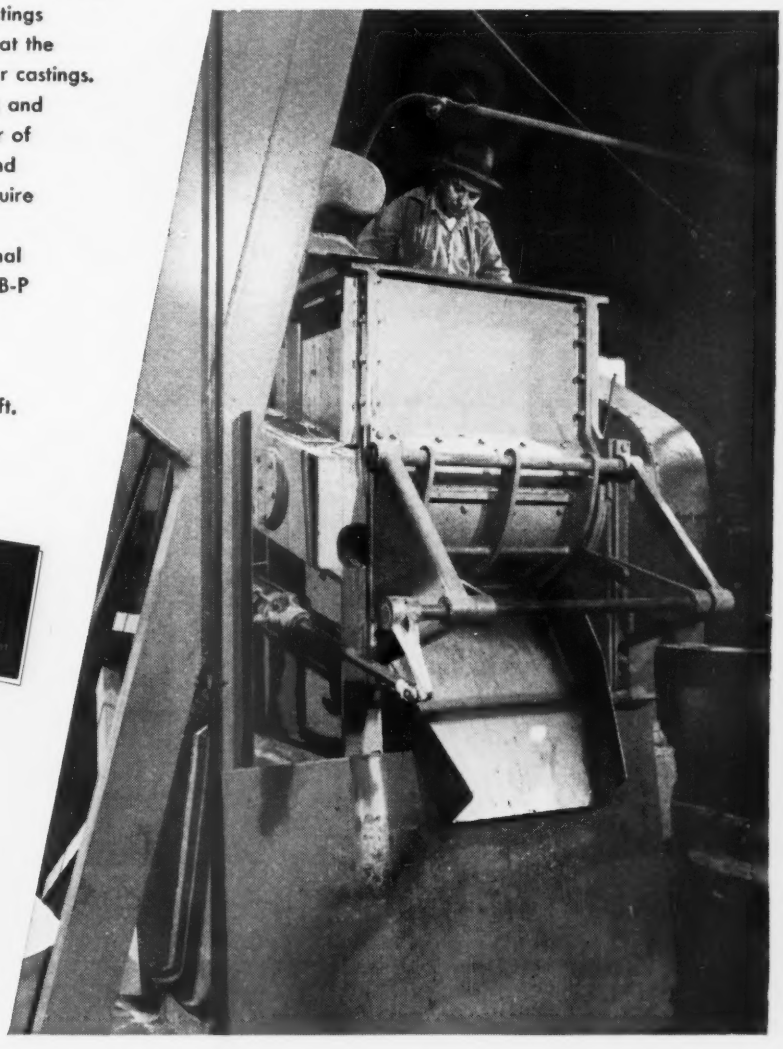
Circle 670 on Inquiry Card—Page 201

"This mixer improves our sand and helps us turn out better castings"

says L. A. Cline, manager of Saginaw Foundries Co.,

about their Baker-Perkins Unidor Core and Molding Sand Mixer

Like many other plants, Saginaw Foundries Co.—a job foundry in Saginaw, Michigan, making a variety of steel castings for automobiles and general industry—has found that the B-P Unidor Mixer is a great help in producing better castings. With a Baker Perkins Unidor, the quality of molding and core sand can be greatly improved, and the number of scrap parts reduced. The Unidor Mixer rubs, stirs, and kneads the sand in one operation, and does not require special aerating attachments. You get complete efficiency from your sand binder, whether conventional or resin, because the powerful Sigma blades of the B-P Unidor distribute the binder in a uniform thin layer over all sand grains. The No. 15 Mixer shown here at work has a capacity of 13 cu. ft., and other sizes available range from lab models up to 30 cu. ft. Steel trough shells have replaceable steel liners, and the steel shoes on the cast steel blades are renewable. The Unidor can be equipped with jacket for heating or cooling. For full details contact a B-P sales engineer or write us today for our equipment bulletin No. F-156.



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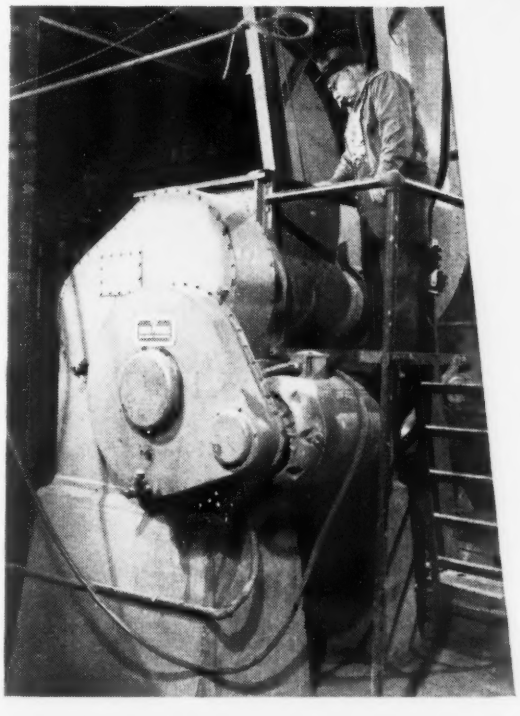
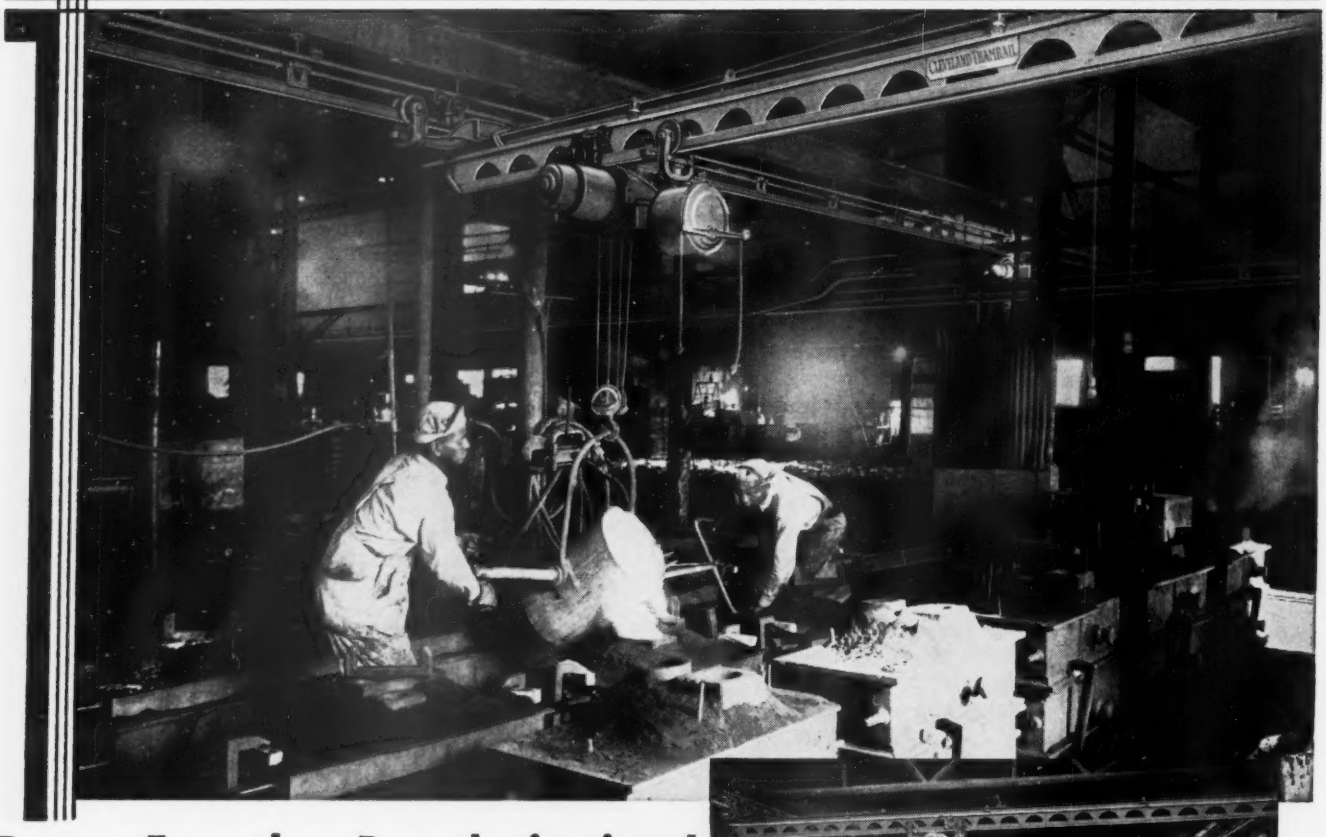


Baker Perkins Inc.

FOUNDRY MACHINERY DIVISION

SAGINAW, MICHIGAN

from LIGHT *to* HEAVY *Production Overnight*



Texas Foundry Revolutionized with CLEVELAND TRAMRAIL

Before the advent of Cleveland Tramrail the Trinity Valley Iron and Steel Company, a gray iron jobbing foundry in Ft. Worth, Texas, was limited to the production of small castings because their flasks, molds, cores and ladles could be no larger or heavier than readily handled by hand, except in the main bay of the shop.

Practically overnight this concern was revolutionized by installation of a Cleveland Tramrail system. It took them out of the small casting class; they now can pour castings of any size, from the smallest to the largest. It cut drastically the time required for handling materials and thereby boosted efficiency greatly. It reduced metal heat loss because conveying time from cupola to mold is less via the Tramrail route. Safety has been aided.

The Cleveland Tramrail system at Trinity Foundry consists of many bridges, hoist carriers, switches and extensive trackage which provides overhead handling service for nearly the entire floor area.

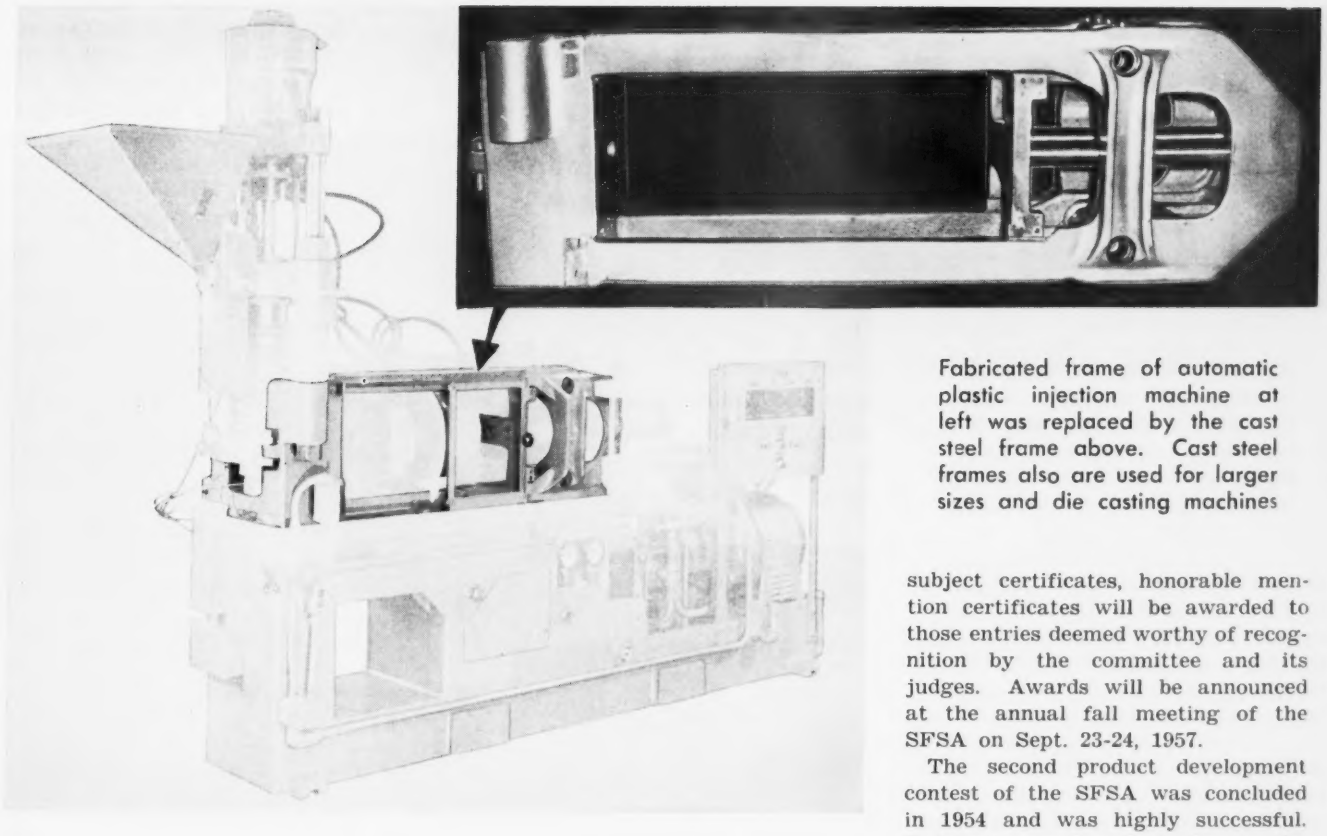
Trinity is now in such a favorable position that it is serving customers over a wide radius, some more than 1000 miles distant. It is doing so expeditiously, with better castings at lower cost.

GET THIS BOOK!

BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
3816 East 286th St., Wickliffe, Ohio

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT



Fabricated frame of automatic plastic injection machine at left was replaced by the cast steel frame above. Cast steel frames also are used for larger sizes and die casting machines

Steel Founders Sponsor Third

Product Development Contest

STEEL Founders' Society of America Inc., Cleveland, has launched its third Product Development Contest, which offers $6300 in cash prizes. Closing date for entries is midnight, June 1, 1957. The contest is conducted every three years under the auspices of the society's Product and Market Development Committee.

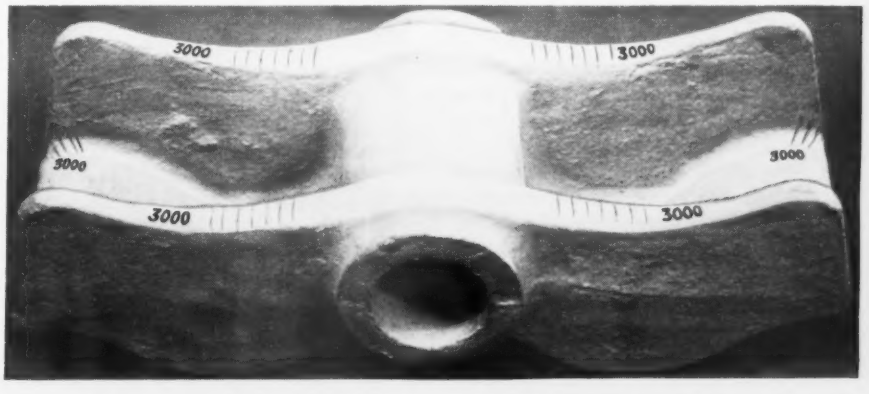
National prizes of $1000, $750, $400, $200 and $100 are being offered in each of two classes. Class I consists of employees of customers of the steel castings industry, professors, college students and engineers. Class II is composed of all employees of producers of steel castings in the United States, Canada and Mexico, except staff members of the SFSA. In Class II, additional cash awards of $100, $50 and $25 will be given in each of the society's eight divisions to employees of member companies.

Further prizes include gold, silver, bronze, blue and steel-gray certificates offered on a national basis in each of the two classes on a list of subjects which cover industrial business practices, engineering and operations. These subjects include functional analysis; engineering a steel casting; redesign of a steel casting; conversion to a steel casting; cast-weld; composite-weld; close tolerance steel castings; improved steel castings performance; treatment of a steel casting; manufacturing operations; administrative factors; inspection; and steel castings in use.

In addition to the cash prizes and subject certificates, honorable mention certificates will be awarded to those entries deemed worthy of recognition by the committee and its judges. Awards will be announced at the annual fall meeting of the SFSA on Sept. 23-24, 1957.

The second product development contest of the SFSA was concluded in 1954 and was highly successful. Entries covered such topics as the use of contour chills to obtain extremely fine grain on die faces; use of alloy additions to overcome specific corrosion problems; attainment of higher safety factors in critical engineering parts such as crane hooks by use of heat-treated steel castings; application of the cast-weld principle to permit production of exceptionally complex castings containing cooling passages in compressor work; use of the brittle lacquer and strain gage methods to develop optimum design; complex sections to reduce hazard from shell fragments in louvered grills for tanks; and production of a composite-weld deck for a foundry shakeout.

Other entries concerned replace-



Cast steel spring equalizer for tandem-axle trailer replaced a four-piece steel fabrication. Markings show results of brittle lacquer and strain-gage tests. Cost and weight were reduced and service failures eliminated

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Only Semet-Solvay has 4 coke plants to serve you. There's one in your vicinity. For fast service, for dependable, uniform coke that means "Better Melting" specify Semet-Solvay Foundry Coke.

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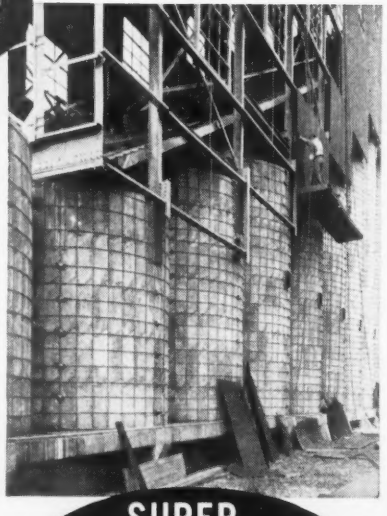
For Better Melting

Circle 673 on Inquiry Card—Page 201

16 NEFF & FRY BINS IN THIS GROUP



These bins are used for handling silica sand. They range in size from 18′ dia. x 52½′ high to 12′ x 12½′. Machinery for screening and grading the sand is mounted directly on the bins without extra supports, proving the load-bearing strength of Neff & Fry construction.

Thousands of Neff & Fry Bins are being used for handling and storing nearly a hundred different kinds of bulk materials, including grain, coal, seeds, minerals, chemicals, clay, wood chips, etc.

Before you decide on storage bins, ask us for complete information. Read our folder, "Bins With the Strength of Pillars." Our bins will likely save you money on first cost, and certainly on maintenance.

SUPER-CONCRETE STAVE STORAGE BINS

NOT EXPORTED EXCEPT TO CANADA AND MEXICO.

The Neff & Fry Co. • 214 Elm St. • Camden, Ohio

Circle 674 on Inquiry Page—Page 201

ment of fabrications with integral steel castings; uses of steel castings in buses, trucks and railroad equipment; and the replacement of several parts by one steel casting in agricultural machinery.

Chairman of the Product and Market Development Committee of SFSA is Roy A. Gezelius, works manager, General Steel Castings Corp., Eddystone, Pa. Other members are T. M. Emery, Massillon Steel Casting Co., Massillon, O.; B. P. Hammond, Continental Foundry & Machine Division, Blaw-Knox Co., Pittsburgh; R. A. Lewis, Los Angeles Steel Castings Corp., Los Angeles; J. A. Ritter, Farrell-Cheek Steel Co., Sandusky, O.; T. H. Shartle, Texas Electric Steel Casting Co., Houston, Tex.; W. H. Shinn, Gunite Foundries Corp., Rockford, Ill.; P. V. Spooner, Missouri Steel Castings Co., Joplin, Mo.; E. J. Warnock, Symington-Gould Corp., Depew, N. Y.; and H. J. Kelly, Dodge Steel Co., Philadelphia.

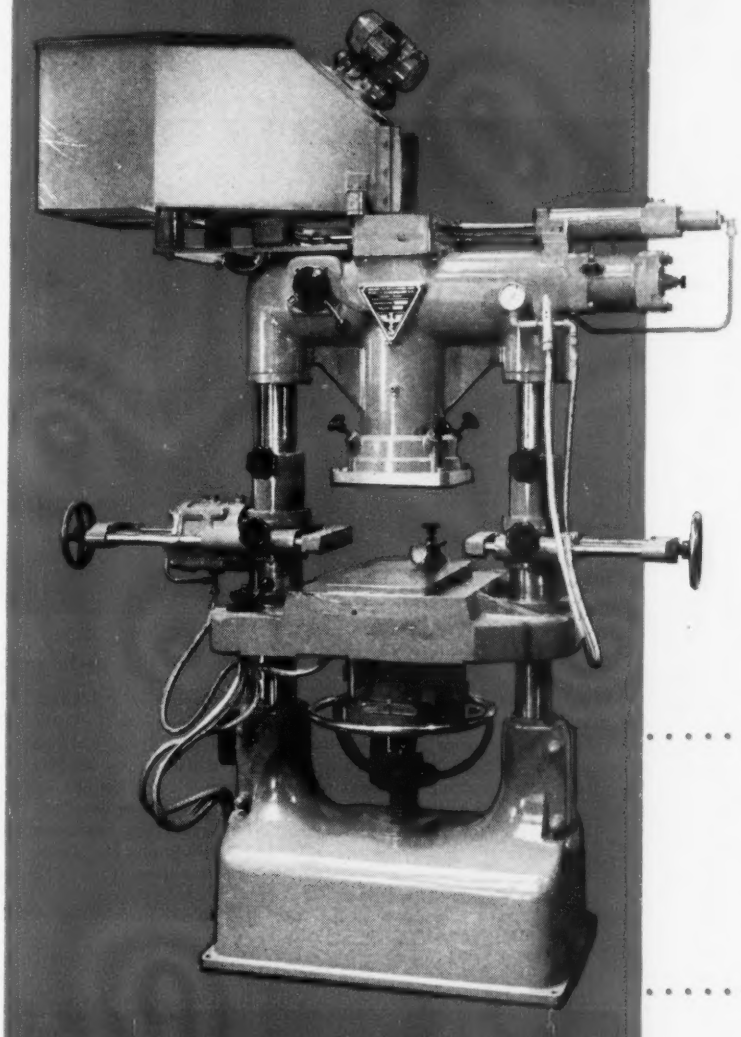
Further information about the contest is available, upon request, from the Steel Founders' Society of America Inc., 606 Terminal Tower Bldg., Cleveland 13.

SAE Issues 1956 Handbook

The Society of Automotive Engineers has released its 1956 *SAE Handbook* containing lists of officers, committee rosters, technical board rules and regulations, technical reports, approved standards and recommended practices covering a wide range of ferrous and nonferrous metals, nonmetallic materials, threads, fasteners and common parts, electrical equipment, powerplant components and accessories, passenger cars, trucks and buses and tractor, earthmoving and marine equipment.

"Jordan, this is not the time or the place for your reducing lessons."

V + S Core Shooter



The V + S Core Shooter is available in 4 sizes of varying capacities. Shoot Heads can be furnished to accommodate all core boxes.

...for fast, economical production of cores

- The V + S Core Shooter is as revolutionary as the first core blower. It offers an entirely new core making technique.
- Extremely high green strength "stand up" cores can be made with any binder —oil, resin, or STEINEX*. This amazing machine will even shoot molding sand.
- Wooden core boxes can be used as successfully as metal boxes. Very little air used.
- Economical for mass production and short runs as well. Core boxes can be changed readily.
- Extremely simple—no motors, relays, wires, no bearings, shafts or plows to contend with—assuring fewer shutdowns and less maintenance cost.

Try This Kleenex Tissue Test

Place half a KLEENEX tissue in the core box and shoot it in the V + S Core Shooter. The Kleenex will not be damaged. A regular core blower will tear it to bits.

Ideal for CO_2 Process with STEINEX because hardening in shoot holes and shoot heads is eliminated.

***STEINEX** is a remarkable core sand binder. Cores and shell molds, made of core sand mixed with STEINEX can be hardened in a few seconds by the injection of carbon dioxide — and used immediately

Phone or Write for Full Information and Literature

STEINEX

CARVER FOUNDRY PRODUCTS CO.

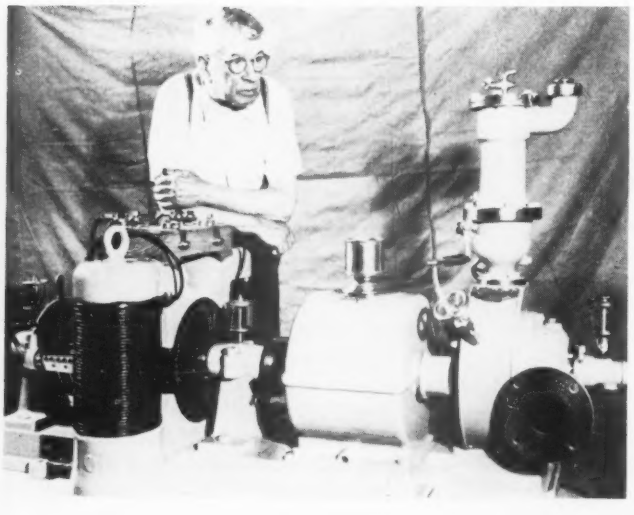
1060 HERSHEY AVENUE, AMHERST 3-1845, MUSCATINE, IOWA

Circle 675 on Inquiry Card—Page 201

News Views

HONORED: Birmingham Chapter of the AFS met recently and honored Dr. James T. MacKenzie, the retired technical director, American Cast Iron Pipe Co. Dr. MacKenzie was one of the founders of the Birmingham Chapter and has given freely his time and energy on behalf of the group. In the picture, Dr. MacKenzie is on the left at the side of Warren Whitney, vice president, James B. Clow & Sons, National Pipe Division, who was master of ceremonies. On the right is John F. Drenning, Kerchner Marshall & Co., chairman of the Birmingham chapter

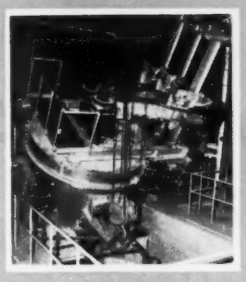
RESEARCH PROGRAM: An initial step in a new research program of product development has been completed by Frederic B. Stevens Inc., Detroit. Geared to complement its Foundry Facings Development Laboratory, the program is designed to test and evaluate new minerals and refractory compounds as possible bases for future foundry products. Tests are made at Armour Research Foundation, Chicago. Miss Jina Varis is seen looking over some of the casting sections undergoing testing



OLD TIMERS: Ed Jones, 77, oldest employee of De Laval Steam Turbine Co., Trenton, N. J., says "so long" to a 10-kw turbine generator made by De Laval and displayed in 1893 at the Chicago World's Fair. It delivered 10 hp at 24,000 rpm and was the first such set to produce electric current on a commercial basis in the United States. The unit has been exhibited at the De Laval plant for many years but has been moved to the Smithsonian Institution, Washington. Mr. Jones began his career in the De Laval pattern department in 1902

SAFETY AWARD: Pittsburgh Coke & Chemical Co. was honored recently for having operated a coke plant for over one-million man-hours without a disabling injury. James F. Malone, left, Pennsylvania Manufacturer's Association official, presents the association's award to John Dods, plant superintendent of the company's Neville Island plant. At right is James Padovese, Pittsburgh Coke safety director. The company recently also was the recipient of the Lammot du Pont Safety Award as the chemical firm which owned the greatest improvement record in plant safety over a five-year period

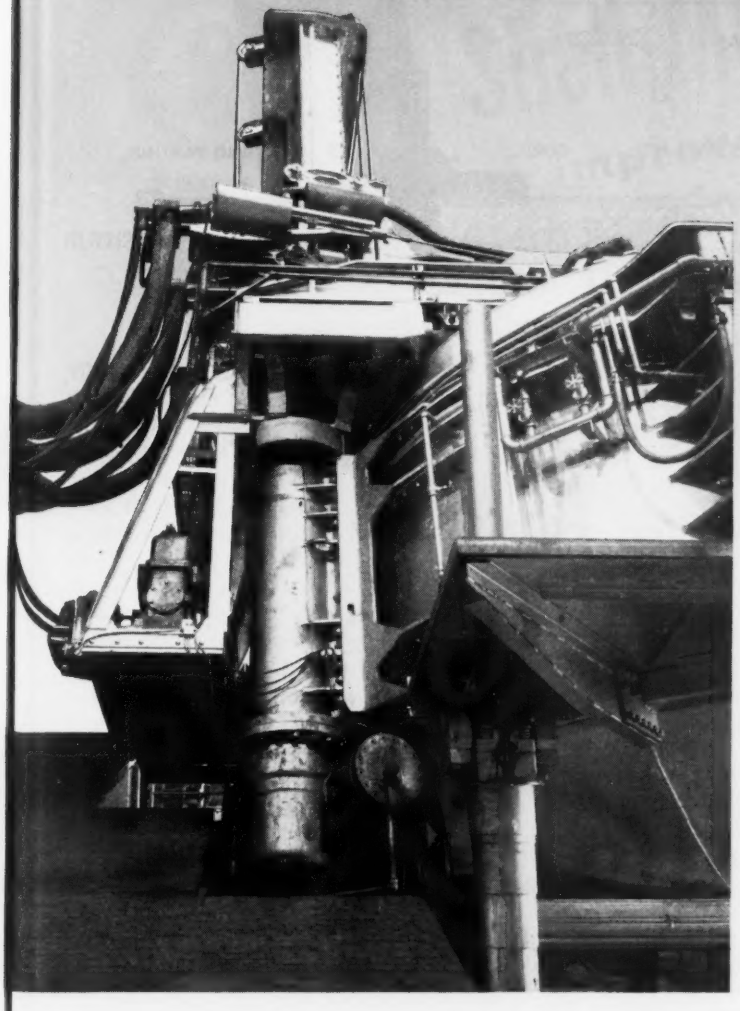
• ONE OF A SERIES OF MESSAGES TO MODERN FOUNDRY MANAGEMENT



SWINDELL

SINCE 1850

FOUNDRY ELECTRIC MELTING FURNACES

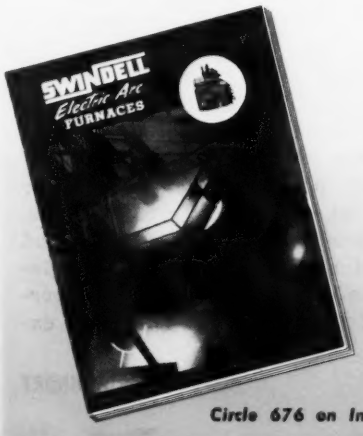


RUGGED OVER-SIZED ROOF CYLINDER

–Another SWINDELL Quality Feature for Fine Furnace Performance

OUTSTANDINGLY SUPERIOR in design, construction and operation, the SWINDELL hydraulic roof lift and swing cylinder is a major operating feature. Perfect alignment, always, is assured by attachment to furnace shell. Permanent engagement with roof superstructure guarantees proper sequence. No manual clamps or kingposts, no special foundations or pits for piping—instead, a single massive unit integral with the furnace, powerful, dependable, smooth in operation year after year. You can depend upon SWINDELL experience. Let it serve you in the foundry field.

SWINDELL Electric Melting Furnaces for foundry service provide the productivity, low maintenance and long, useful life built-in by genuine steel mill design and construction by steel mill melting furnace specialists. Write for a consultation.



WRITE for your copy of the latest Swindell Electric Melting Furnace Catalog — sent promptly on request.

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Designers and Builders of Modern Industrial Furnaces
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Circle 676 on Inquiry Card—Page 201

Trouble Shooting

By C. W. AMMEN

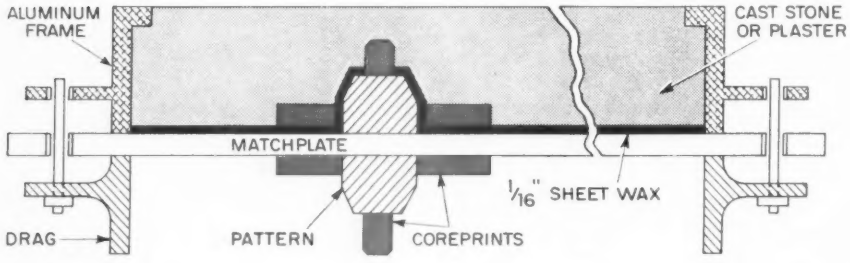
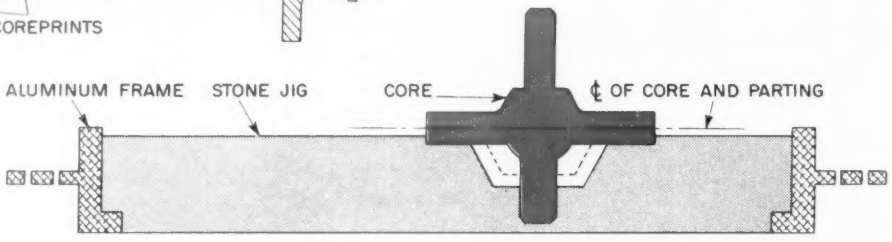


Fig. 1—Assembly of equipment used to produce jigs for setting cores is clamped as shown

Fig. 2—Cross section of core-setting jig shows core placed in locating prints. Drag is set over jig, both are rolled over and jig removed, leaving cores properly set in the drag



Jig for Setting Cores

Dear Charlie:

We produce some jobs in which two cores are fitted around each other, then set into the drag prints and lined up carefully with a wooden frame so as not to crush when the cope is put on. They are quite a task—production is slow and scrap high. Only one in ten molders can come anywhere near making any production on the job. You know what happens if the molder was celebrating the night before and is a wee bit shaky. Even some jobs with a single core to each cavity, such as a big gang of fairly long pin cores set into a drag, are a mess. I have a squeezer hand who is hell on wheels when it comes to 12 x 18s with no cores to set, but give him cores and he is a dead duck. He will make lots of scrap just by messing up the drag with his fingers or with the cores. What's a good, cheap way to rig or to combat this problem?

Sincerely,
Sam

Dear Sam:

We all have trouble setting difficult types of cores and combinations of interlocking cores, but there is a simple and effective method you can use to mold one-man flasks when the drag can be turned over without damage or dropouts. Yours is not a new or isolated case. Some very fast squeezer hands are sloppy and slow in setting multipiece, over, under or keyed cores. The condition you speak of is somewhat more common today than it used to be, but not as much as we put on when we talk about the good old days with skilled molders and no scrap.

I am sure you remember Jim's gray iron shop where they used to make the old forerunners of our modern water heaters. Remember the small flash boiler which hung on the wall and lit when the hot tap was turned on? You got everything from ice water to superheated steam, and on occasion one of these rigs would blow the entire side out of the house. I am sure some of them still are in operation even today.

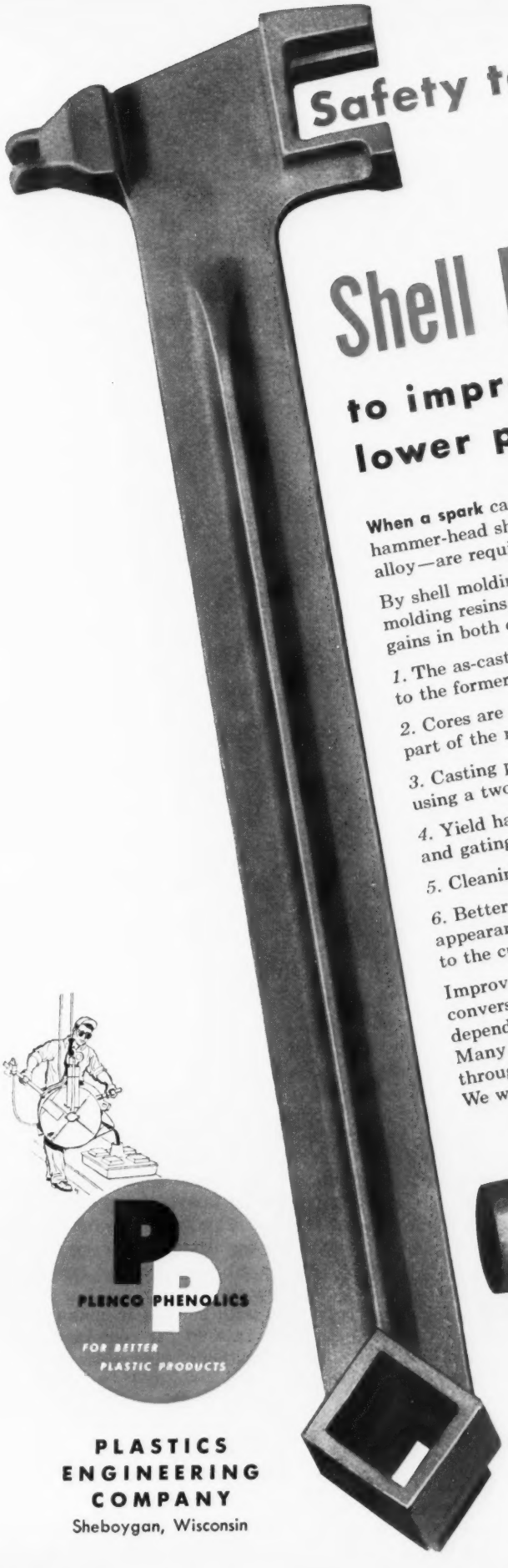
Well, the burner core on those little rascals was quite a core to set by hand without putting fingers into the drag. There was little or nothing to hold on to. The old man had two in a 12 x 18, 2½ x 2½ and each molder was equipped with a false cope made of a frame with lugs and of reinforced plaster of paris.

In operation, the molder placed the two cores in the false cope and blew off. He cored up his mold by placing the drag on the false cope containing the cores, flipped it over and drew off the false cope, leaving the cores set correctly, without any damage to the drag. Even though this method adds some operations, they are offset by the speed with which the cores can be loaded into the fixture because a man can load without fear of messing anything up. On difficult core setting, it is by far much faster and reduces scrap caused by faulty and dirty core setting by 90 per cent.

When a core setter is used, several fixtures can be made up on the same job. In a jobbing foundry, you should take advantage of aids like a jig for setting cores, etc. Their value is not confined to large production foundries, but will prove themselves in a small shop as well. As an illustration I will outline the method for making a simple, inexpensive single-purpose core-setting jig which will more than pay for itself.

The method used to produce these jigs is about as simple as it can be. A metal frame of cast aluminum, with lugs to match the drag flask, is made up to the necessary height. The pattern plate is placed on the drag pins, and the frame is put on. The entire assembly is clamped as shown in Fig. 1. Cut out a piece of sheet wax 1/16-in. thick about ¼-in. bigger all around than the inside dimensions of the flask. Place it in warm water until it is limber and very pliable.

Next, place the wax inside the flask, on top of the cope patterns, and work it down all over and around the edges of the flask, giving the entire area a 1/16-in. covering of wax. The next step is to ex-



Safety tools of spark-resistant

AMPCO®

THE METAL WITHOUT EQUAL

Shell Molded with Plenco

to improve casting quality... lower production costs

When a spark can mean a hazardous explosion, the bung wrench and hammer-head shown—made of AMPCO metal, a special copper-base alloy—are required for safety considerations.

By shell molding their line of safety tools with Plenco phenolic molding resins, Ampco Metal, Inc., Milwaukee, make substantial gains in both economy and quality:

1. The as-cast condition of the shell-casting is clearly superior to the former green sand casting.

2. Cores are eliminated on the bung wrench; they're now part of the mold.

3. Casting production per man hour is doubled on the wrench using a two-station machine.

4. Yield has increased about 5% due to use of a smaller riser and gating system, and scrap has been reduced considerably.

5. Cleaning costs, also, are considerably reduced.

6. Better detail, sharper corners, and greatly improved overall appearance delivers a far better casting and product to the customer.

Improvement in quality and lowering of cost has made conversion to the modern shell molding method with dependable Plenco resins well worthwhile for Ampco Metal, Inc. Many other foundries have experienced equivalent gains through Plenco shell molding research and engineering. We welcome the challenge of *your* particular problem.

PLENCO PHENOLICS

FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY

Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic compounds, industrial resins, and coating resins.

Circle 677 on Inquiry Card—Page 201

pose the core prints by cutting away the wax. The amount of the print to expose depends on the nature of the job, but usual practice is to expose the entire print except 1/16-in. from the point where the print is attached to the pattern—that is, the pattern is covered by 1/16-in. extending 1/16-in. out on the print. Also, the print is exposed to within 1/16-in. of the parting all around.

After this job has been done, the exposed prints are given a coating of parting, such as a shortening or a prepared plaster and stone parting. When the outside of the frame has been mudded up with modeling clay, you are ready to pour your false stone cope. You can cast it with plaster or any of the fine castable stones available to the industry, and it may be reinforced with excelsior, horsehair, wire mesh, etc. After the casting has set and has been removed, allow it to dry overnight. Give it a good coating of shellac all over with color on the core prints. This step will assist somewhat in setting the cores. If you choose, the bottom of the frame can be covered with a board.

Should the pattern be extremely tall in the cope, you can let it stick through, as the cores will in some cases. Then you must provide a leg at each corner to hold it up to the proper height and to allow the cores to be set in the prints with portions hanging through the jig. This operation is similar to making a dry sand follow board or match, but it is used for locating and setting the cores. Since these jigs last for years if properly cared for, a few hours invested in rigging a dirty job are picked up pretty fast.

Sincerely,
Charlie

Sets Up Classification System For Power-Actuated Valves

A standard classification and terminology system for power-actuated valves has been adopted by the Fluid Controls Institute. Formerly the National Steam Specialty Club, the organization includes manufacturers of control valves, regulators, solenoid valves, controllers, etc.

The institute undertook the project to provide a practical framework of standard terms for the everyday use of engineers and mechanics. It is expected to clear up existing ambiguities and uncertainties and to provide a broad base for new and accepted terms and names which should be recognized and preserved.

Results of the project have been published in a 12-page booklet entitled "Standard Classification and Terminology for Power Actuated Valves" which is available from the Fluid Controls Institute, Box 191, Decatur, Ill.

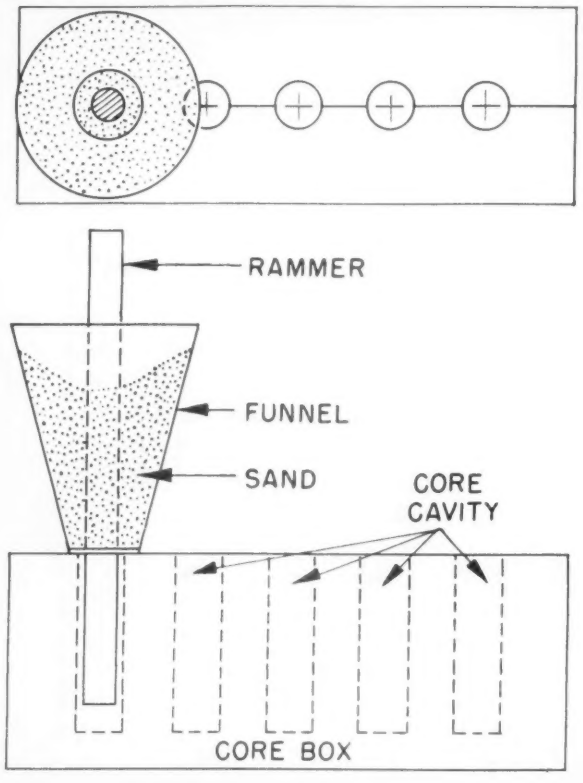
Book Review

ASTM Standards, 1955, *Part 3, Cement, Concrete, Ceramics, Thermal Insulation, Road Materials, Waterproofing, Soils,* 2017 pages, 6 x 9 in., published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3. Price $13.50.

Contains over 500 formally adopted standards, tentative specifications, methods of test and definitions relating to materials indicated in the title.

The book is divided into 21 subdivisions including cement; lime; gypsum; magnesium oxychloride and magnesium oxysulphate cements; asbestos-cement products; chemical-resistant mortars; mortars for unit masonry; masonry building units; pipe and drain tile; refractories; ceramic whiteware; porcelain enamel; glass and glass products; thermal insulating materials; natural building stones; mineral aggregates, concrete and non-bituminous highway materials; bituminous materials for highway construction, waterproofing and roofing; soils; thermometers; general testing methods, and recommended practices and definitions.

HOW TO DO IT



Funnel Helps in Hand Ramming Small, Standardized Cores

By HENRY M. GRIFFOUL
San Jose, Calif.

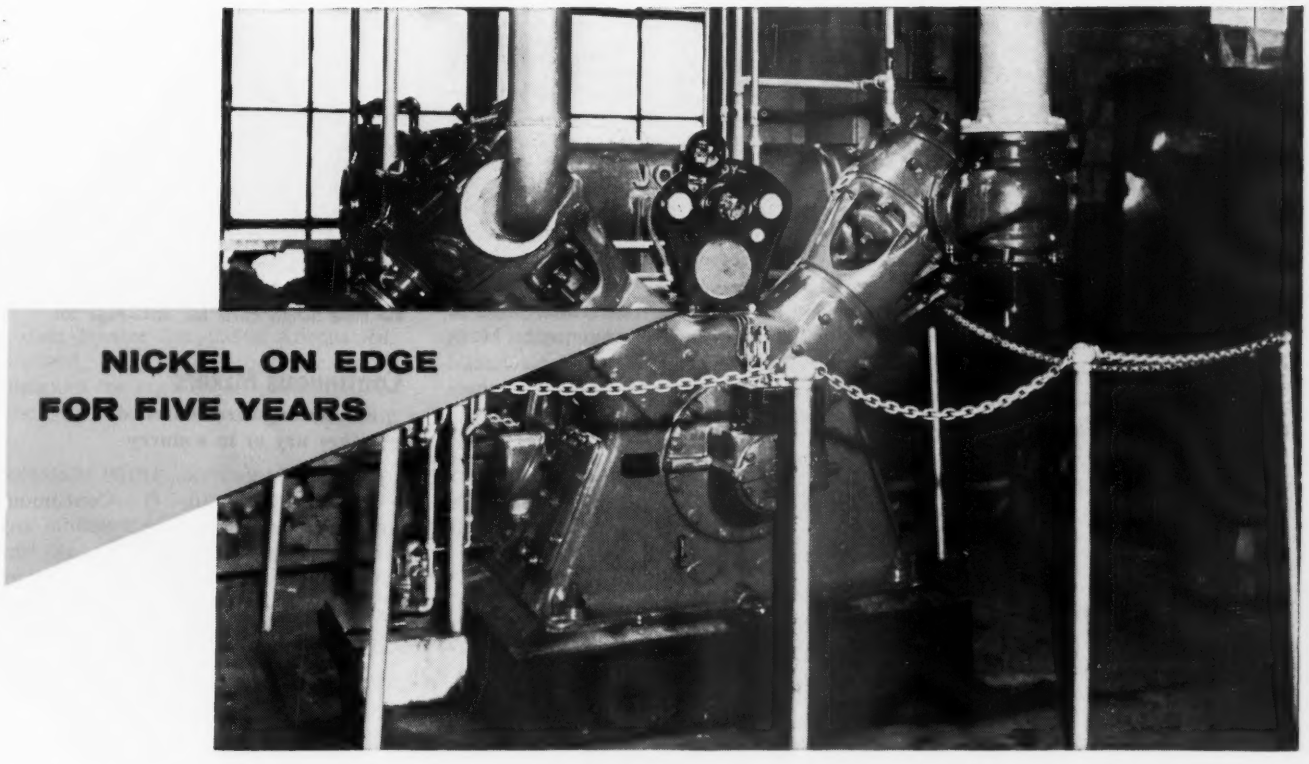
SMALL, standardized cores are used in most foundries. Common types are those with a vertical elevation such as Xs, Ts, Ys and cores for bushings or cylinders. Many shops hand-ram such cores in gang boxes. The smaller the core, the more time required to fill up the several cavities.

Production can be speeded by using a funnel with the taper tube removed. The funnel should be big enough to hold sufficient sand for ramming one or several cores. Sand is scooped up with the funnel, which is placed over a corebox cavity, and rammed into the cavity. The rammer head should be small enough to fit into the cavity opening.

The idea has been used with success in making CO_2 cores at a production rate 60 per cent faster than other hand ramming methods. Also, wear and tear on the corebox is reduced.

Do you have any tricks of the trade tucked away with your foundry experience? Why not release them to fellow foundrymen? FOUNDRY will pay a minimum of $15 for each idea submitted and published. Send a photo or drawing with your idea

Proof... the JOY WN-112 COMPRESSOR is Vibration-free



VICE PRESIDENT GEORGE F. FRANCK, of American Tank & Fabricating Company, Cleveland, writes about his Joy Compressor:

"Although the WN-112 has been in constant use for five years, we have experienced no trouble. It is vibrationless in operation . . . we are delighted with its performance."

The Joy WN-112 is a heavy-duty, continuous service, double-acting, water-cooled compressor with capacity from 378 to 974 CFM, 125 psi. Its vibrationless performance is the result of balanced V-vertical cylinder design with flange-mounted motor.

Other features of the WN-112 that assure efficient, quiet operation and long service are the exclusive Joy "Dual Cushion" valves, the *replaceable* cylinder and crosshead liners, full force-feed lubrication (even to the crosshead face), and oversize non-adjustable spherical-type main bearings.

For complete details on Joy WN-112 Compressors, write ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

A nickel was balanced on edge on this compressor (American Tank & Fabricating Company) when it was started up five years ago. It is still standing there!

Write for FREE Bulletin 90-13

Consult a Joy Engineer

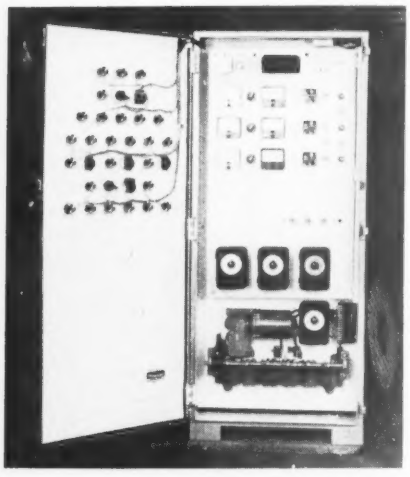
For Air and Gas Compressors, Oxygen and Nitrogen Generators, Vacuum Pumps and Boosters, Conveyors, Fans, Electrical Connectors, Hydraulic Fittings and Hose Assemblies.

W-SW 16093-90

JOY

SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885

New Equipment and Supplies



Sand Moisture Control

operates automatically while mixture is being prepared

Haylco Controls Corp., Neenah, Wis.—Sand moisture controller houses all essential equipment in a single cabinet. All equipment is interlocked for every phase of the mixing operation, and indicating panel lights identify each phase of the cycle. Sensing probe is installed in the mixer and determines existing temperature and moisture as the sand is being blended. Water is added in three stages as the sand is being mixed, to bring final moisture content to the exact level desired with no increase in mixing time. Unit reportedly can be used on any batch type mixer regardless of charging method. Connections are made through top of the cabinet to allow flexibility and convenience in placement of the controller.

For More Details Circle No. 401—Page 201

Testing Machine

automatically maintains fixed extension at any temperature

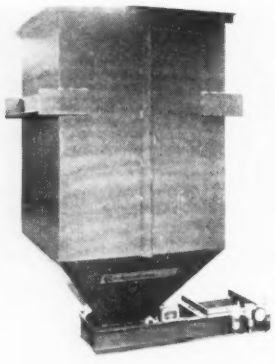
Tinius Olsen Testing Machine Co., 5364 Easton Rd., Willow Grove, Pa.—Automatic testing machine is for maintaining a fixed extension or strain when testing at elevated temperatures. Specimen to be tested is inserted in a circular testing furnace mounted between the crossheads. Furnace can be used at any temperature up to 1800-2000° F with temperatures controlled by a separate unit. A predetermined extension (in in. per in.) is selected. Load is applied until the fixed extension is attained. As specimen tends to strain further under influence of increasing temperature and load, the load is automatically reduced to maintain the fixed extension. All variations are automatically recorded on a dial indicator.

For More Details Circle No. 402—Page 201

Hopper Scale

is for weighing from a series of feeders or a single hopper

Richardson Scale Co., Van Houten Ave., Clifton, N. J.—Automatic, suspension type hopper scale makes possible cumulative weighing from either a series of feeders or a single hopper. Scale can be used for batch weighing of most materials, with a suitable feeding arrangement. Models with either air-operated discharge gates or a manually operated handwheel are available. Dial head can



be made with magnetic mercury or a potentiometer cutoff. Seven different models, ranging from 33 to 200 cu ft, with capacities up to 6000 lb can be supplied. Scale can be used with any standard feeding arrangement—gravity fed from bins, screw-fed, belt-fed or from a vibrating conveyor.

For More Details Circle No. 403—Page 201

Riddle

reproduces mechanically the action of hand riddling

Martin Equipment Co., Box 173-F, Wabash, Ind.—Riddle features a "mechanical arm" that reproduces the action of hand riddling. Removable screen is supported in a fixture. An adjustable stop is furnished to give a range of desired movement any place within 360 degrees. Riddle can be installed to either right or left of molding machines on a tripod stand adjustable for height. Other units without tripod for mounting on portable molding machines or hopper

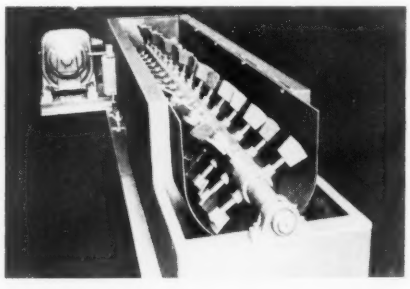
type sand handling equipment can be supplied. Riddle also can be used as a portable floor sand conditioner. Power is supplied by a 220/440 v, ¼-hp totally enclosed ac motor.

For More Details Circle No. 404—Page 201

Continuous Mixers

handle any size material, either dry or in a slurry

Gas Machinery Co., 16100 Waterloo Rd., Cleveland 10, O.—Continuous mixers and pug mills will handle any size material from dust to 1½ in., either dry or in a slurry, at rates of 20 to 30 cu yd per hr. Unit features a 10-hp gearhead motor and chain drive, fully radially and angularly adjustable paddle tips and round center shaft with slip-on type paddle hubs. Discharge is at open end of trough into a closed sidewall chamber with an open bottom. Final mix is delivered into full chamber and is drawn from the bottom as needed. Empty chamber invites spillage and



consequent granular segregation below. While made in standard sizes, they can be supplied with product capacities to fit particular needs.

For More Details Circle No. 405—Page 201

Eddy Current Brake

provides accurate control to electric monorail type hoists

Yale & Towne Mfg. Co., 11000 Roosevelt Blvd., Philadelphia 15, Pa.—Eddy current brake for use on

For More Details on These Items
Use Reply Card—Page 201

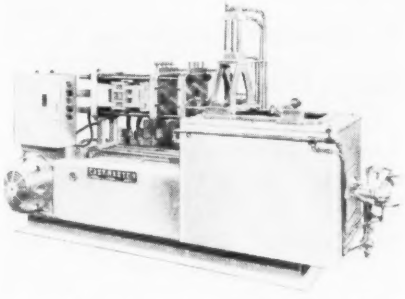
monorail hoists reportedly provides positive, accurate control from no load to full capacity when hoisting or lowering by electromagnetically providing a full capacity load on the hoist motor at all times. This motor braking principle is expected to find usage where exceedingly gentle hoisting and lowering is essential because of the nature of the load, as in die handling, coresetting and mold handling.

For More Details Circle No. 406—Page 201

Die Casting Machine

is for high-speed production of castings up to 3 lb

Cast-Master Inc., 23901 Aurora Rd., Bedford, O.—Die casting machine is designed for high-speed production of zinc, tin or lead castings weighing



up to 3 lb. Cycle permits 1300 shots per hour with one second dwell. Model is 48 in. high to the top of the accumulator, 28 in. wide and 97 in. long. Unit includes the features contained in the company's larger models.

For More Details Circle No. 407—Page 201

Detachable Couplers

can be attached to air tools without using lead hoses

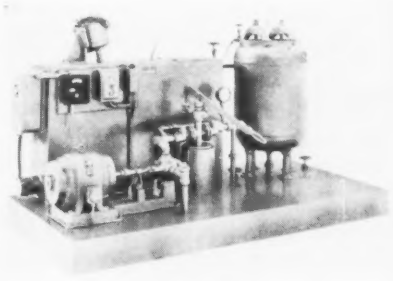
Foster Mfg. Co., 3850 Gravois, St. Louis 18, Mo.—Detachable couplers provide quick, automatic plug-in and snap-out coupling for air, oil or grease lines. Couplers can be used directly with reciprocating air tools without using lead hoses.

For More Details Circle No. 408—Page 201

Casting Impregnator

is portable and seals castings with a metallic sealant

Tincher Products Co., 2023 South 60th St., Milwaukee 14, Wis.—Portable, high-pressure impregnation



equipment seals porous castings with a metallic sealant without need for a vacuum cycle. Impregnator employs one electrical outlet and can be moved readily from one location to another. Unit covers 21 sq ft of floor space, using gas, steam or electricity as a heating medium and operates on either 220 or 440 v, ac current. It can be built to specifications.

For More Details Circle No. 409—Page 201

Wire Rope Clips

are engineered for safety in tough, heavy-duty service

American Chain & Cable Co., Wire Rope Division, Wilkes-Barre, Pa.—Wire rope clips are drop-forged from high-grade steel and are said to provide positive grip for tough, heavy-duty service. Base channel is shaped to hold the wire rope securely without damage to individual strands. The U-bolts are protected from corrosion by hot-dip galvanizing after threading. Clips are made to secure ropes of ⅛ to 1¼ in. diameters.

For More Details Circle No. 410—Page 201

Portable Grinder

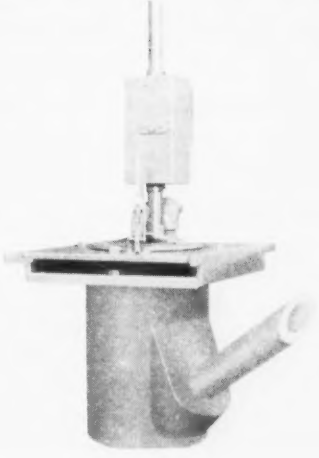
is lightweight but powerful enough to handle heavy work

J & H Products Co., 3007 Elm St., Dallas, Tex.—Portable grinder weighs 14 lb yet provides 2 full horsepower.

Ladling Unit Permits Automatic Processing

AUTOMATIC LADLING unit for aluminum makes possible fully automatic processing of many types of castings—especially aluminum die castings and permanent mold. The unit is made of special refractory materials and so arranged that the molten metal being ladled cannot come in contact with any metal structure. The basic pump contains no moving parts, check valves or other devices. The ladling unit operates on the principle of a pressurized chamber, with the size of the shot depending upon both the time of pressure application and the pressure. In operation, the ladled metal is withdrawn from beneath the surface of the bath.

Ladling range covers a wide latitude and can be adjusted instantly and accurately to vary the size of the shot. Normally, the equipment is supplied to cover the range of 1 to 10 lb of aluminum. Other sizes of shots in aluminum or other metals are also available. Accurate control of any size shot within its range is provided with no interruption of the casting cycle during charging of metal. The equipment is adaptable to electric furnaces or fuel-fired reverberatory furnaces with no variation in size of shot through

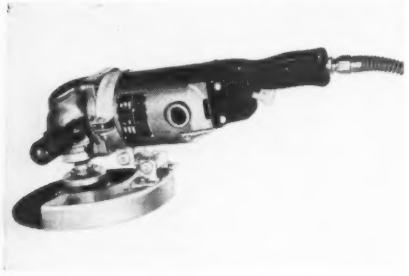


change in metal level.

The entire assembly is supplied as one package consisting of one ladling unit ready for immersion in molten metal, one control cubicle assembled and wired and one pressure blower. All panel cubicle internal equipment is front mounted and wired and front accessible to facilitate inspection. Dimensions are 17½ in. wide x 21 in. deep x 72 in. high. Operating voltage is 220 or 440 v as specified. The equipment is made by Lindberg Engineering Co., 2450 West Hubbard St., Chicago 12, Ill.

For More Details Circle No. 440—Page 201

Alignment for the high-torque motor is maintained by use of sealed, preloaded ball bearings. Spindle thrust is taken by double-row ball bearings. Cool operation is assured by a cooling fan and vents. An automatic overload protection switch prevents



motor damage. Matched spiral bevel gears transmit torque to the grinding spindle. Magnesium housing and balanced design aid handling ease.

For More Details Circle No. 411—Page 201

Seal Fitting

is designed for use on all types of piping installations

Flick-Reedy Corp., Tru-Seal Division, 2040 North Hawthorne Ave., Melrose Park, Ill.—Seal fitting reportedly eliminates leaks at pipe thread connections without use of sealing compounds. Fitting is installed by threading on pipe or fitting, turning "hand tight" to desired position and tightening with light torque. It is designed for use on any pipe thread, dry seal or standard; for use on oil, water, gas, steam, vacuum and chemical fluid lines (except those carrying fluorine gas or molten alkaline metals); for operating temperatures of −280° to +500°F and for pressures up to 3000 psi. Convenient sizes to fit the vast majority of piping installations are available.

For More Details Circle No. 412—Page 201

Weighing System

is available for all standard fork lift truck capacities

Baldwin-Lima-Hamilton Corp., Electronics and Instrumentation Division, 806 Massachusetts Ave., Cambridge, Mass.—Fork lift truck weighing system is available for all standard truck capacities and can be used for weigh counting for inventory con-

trol, batch process weighing, check weighing incoming shipments and weighing inter-plant shipments. The system incorporates a load cell hermetically sealed within a steel housing. Load on the forks is transmitted to the element which is relatively insensitive to load position. Weighing accuracy is reported as ¼ per cent of full range or better. Instrument requires 6-v power which can be obtained from the battery. Voltage variations assertedly will not affect the inherent accuracy of the system.

For More Details Circle No. 413—Page 201

X-Ray Film

extends versatility of industrial radiographic equipment

Eastman Kodak Co., Rochester 4, N. Y.—Industrial X-ray film has been developed to give the industrial photographer new versatility in working with all types of x-ray machines and gamma ray sources. Film speed ranges from about 1.3 to more than 2 times that of Type A film. The new film reportedly reduces exposure time, provides increased radiographic sensitivity, gives greater subject contrast, more detail and easier readability, shortens the processing cycle and reduces the possibility of pressure desensitization under shop conditions.

For More Details Circle No. 414—Page 201

Plastic Blow Gun

is designed for several special industrial situations

A Schrader's Son, Division of Scovill Mfg. Co., 470 Vanderbilt Ave., Brooklyn 38, N. Y.—Lightweight plastic blow gun is designed for industrial use where electrical disturbance, scratching or weight is a problem. The weight of the gun is a fatigue-reducing factor where repetitive operations tire operators. Simplicity and durability of parts, free flow of air and functional design with com-

fortable grip and positive direction are advantages reported by the manufacturer. Parts are replaceable and interchangeable with company's air control products and guns.

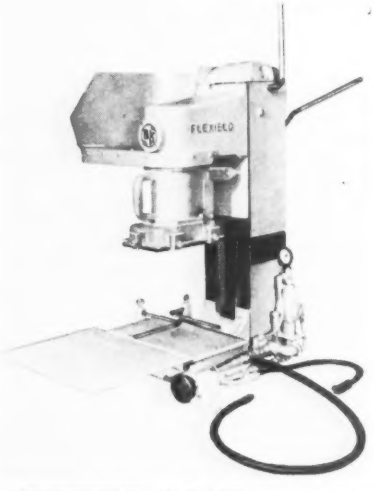
For More Details Circle No. 415—Page 201

Small Parts Washer

operates automatically and uses 10 sq ft of floor space

Ransohoff Inc., 1001 Ford Blvd., Hamilton, O.—Automatic small parts washer occupies 10 sq ft of floor space and can process up to 40

Automatic Bench Coreblower Has 4-in. Draw



EXTENDED DRAW bench type coreblower with full 4-in. draw reportedly provides twice the draw capacity previously available in this type of high-speed, pushbutton bench coreblowers. The machine permits handling of horizontally-split coreboxes on a fast production cycle, with the top half of the box attached directly to the blower magazine. One-piece boxes requiring up to 4 in. of draw also may be handled on the same machine attached to the blower magazine. In such cases, the cores are blown directly onto plates and the box drawn automatically from the core.

A table clamp unit is available for all models for handling vertically-split boxes. A diaphragm-operated clamp provides high-speed automatic clamping and, like the draw, the clamp is operated automatically as part of the cycle. The entire cycle is actuated by a single palm pushbutton control. The coreblower is manufactured by Beardsley & Piper Division, Pettibone Mulliken Corp., 2424 North Cicero Ave., Chicago 39, Ill.

For More Details Circle No. 441—Page 201

HELPFUL
Foundry Literature

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461. Cupolas and Chargers

Modern Equipment Co., Port Washington, Wis.—Catalog 147-C illustrates and describes several basic types of metal charging systems and suggests combinations and alternate ideas to expand the applications to provide a custom-made system for all foundries. Engineering data on design, construction and selection of cupolas also are included.

462. Automatic Ladling Unit

Lindberg Engineering Co., Lindberg-Fisher Division, 2450 West Hubbard St., Chicago 12, Ill.—Bulletin 570 describes an automatic ladling unit for aluminum that is said to permit fully automatic processing of many types of castings, especially aluminum die casting and permanent mold.

463. Portable Mullers

Beardsley & Piper Division, Pettibone Mulliken Corp., 2424 North Cicero Ave., Chicago 39, Ill.—Bulletin 1615 presents photographs, cutaway views, specifications and general information on several portable mullers of varying capacities.

464. Refractories

Carborundum Co., Refractories Division, Perth Amboy, N. J.—Vol. 1, Nos. 1, 2 and 3 of company's publication, "Refractories," cover heat conductivity, chemical resistance and stability and thermal-shock resistance, respectively. Issued bimonthly, the aim of the publication is to tell the metalworking industry more about Carborundum's refractories.

465. Separation Magnet

Stearns Magnetic Inc., Milwaukee 46, Wis.—Bulletin 25-D provides information on line of suspended separation magnets for use with conveyor systems to dig out imbedded tramp iron in the flow of material. Magnets are available in a variety of standard sizes or are built to individual customer specifications.

466. Nondestructive Testing

Magnaflux Corp., 7300 West Lawrence Ave., Chicago 31, Ill. — Booklet, "Lower Manufacturing Costs," looks at nondestructive testing systems, presents some of the philosophy behind the use of test systems in manufacturing and examines testing as a production tool where it can help increase output and profits.

467. Liquid Meter

Baker Perkins Inc., Foundry Sales Division, Saginaw, Mich.—Bulletin F-155 spotlights the dimensions, features and operating principles of an automatic liquid metering unit designed to take the guesswork out of water and oil requirements for batch sand mulling.

468. Hardness Testers

Wilson Mechanical Instrument Division, American Chain & Cable Co., 929 Connecticut Ave., Bridgeport 2, Conn.—Bulletin DH-328 illustrates

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three models of micro and macro hardness testing machines. Vertical capacities, load in grams, weight in lbs and application principles are included.

469. Buyer's Guide

Hickman, Williams & Co., 1650 Union Commerce Bldg., Cleveland 14, O.—Revised buyer's guide provides descriptive data on raw materials and products distributed and serviced by the company. Abrasives, coals, coke, ferroalloys, fluxes, pig iron, sands, clays, refractories, charcoal, charcoal briquets and mill scale are among the items covered.

470. Blast Cleaning

Wheelabrator Corp., 1102 South Byrkit St., Mishawaka, Ind.—"Shell Mold Casting Cleaning and Finishing News" presents three illustrated case histories highlighting abrasive blast cleaning of shell mold castings to remove sand, scale, discoloration and grinding lines.

471. Control Valves

C. B. Hunt & Son Inc., Salem, O. —Bulletin 561 describes line of air and hydraulic control valves said to offer new features including an exclusive shock resistant mounting for the solenoid that reduces hammering and vibration.

472. Aluminum News

Reynolds Metals Co., Desk ES, 2500 South Third St., Louisville 1, Ky.—*Reynolds Aluminum Digest,* a monthly publication containing 50 to 60 reviews of articles relating to aluminum that have been published in the technical press in the preceding 30-60 days, is being made available to the metalworking industry. A news summary of related current events, statistics on the aluminum industry and patent listings also is included.

473. Abrasive Price List

Bay State Abrasive Products Co., Westboro, Mass.—New pricing book replaces former pricing material with one or two exceptions and is so arranged that most special wheel shapes can be priced in a simple manner similar to straight wheels. Prices are generally unchanged and the book is not a notification of a price change but rather a notification of a change in the method of pricing the company's products.

474. Sodium Silicate

Grasselli Chemicals Dept., E. I. du Pont de Nemours & Co., Wilmington, Del.—Product information sheet A-1885 discusses the CO_2 process, its advantages, grades of sodium silicate suitable for use, binder materials and additives. A bibliography on the subject also is included.

475. Centrifugal Fans

Trane Co., La Crosse, Wis.—Bulletins DS-348B and DS-348F have been revised to include new features and data on Class I and II centrifugal fans. The bulletins cover fans with backwardly inclined blades and forward curved blades, respectively.

476. Heat Treating

Alloy Casting Institute, Mineola, N. Y.—Reprint, "Materials Handling at High Temperature Mechanized with Cast High Alloy Heat Treating Parts," is a detailed story of how cast high alloy furnace parts and auxiliary equipment are aiding the mechanization of heat treating operations.

477. Export Guide

Consolidated Freightways, Dept. GSD, P. O. Box 3618, Portland 8, Oreg.—A documentation guide compiled from official United States and Canadian customs publications is designed to aid those who export merchandise by motor freight from the U. S. to Canada.

478. Hose Fittings

Hose Accessories Co., 2700 North 17th St., Philadelphia 32, Pa.—Bulletin 110 details information important to line of steel, malleable and bronze air hose couplings, hose clamps, hose nipples, valves and manifolds for use wherever compressed air is used.

479. Bridge Lock

Bacon Crane & Hoist Corp., 35 Division Ave., Brooklyn 11, N. Y.—Bulletin 1353 discusses features of a bridge lock designed to insure safe method of locking an underhung crane to a connecting spur track for transfer service.

480. Shelving

Standard Pressed Steel Co., Hallowell Division, Jenkintown, Pa.—Tips on how to plan installations and order shelving in more than 1000 combinations to fit any storage or supply handling need are summarized in catalog.

481. Industrial Presses

Manley Division, American Chain & Cable Co., York, Pa.—Bulletin DH-486 details specifications, capabilities, capacities and accessories for indus-

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trial presses that are hydraulic or air-operated with 25 to 150-ton capacities. Ten models are available.

482. Company Directory

General Motors Corp., 1104 Terminal Tower Bldg., Cleveland 13, O.—Revised booklet, "Selling to GM," contains a directory of GM manufacturing divisions with a list of civilian and defense products made by each. It invites suppliers wishing to do business with GM to contact purchasing departments of divisions or plants which they believe they can serve.

483. Welding News

Air Reduction Sales Co., Division of Air Reduction Co., 150 East 42nd St., New York 17, N. Y.—Vol. 16, No. 2, "Airco in the News," presents a series of stories highlighting industrial use of company's gas and welding equipment.

484. Woven Wire Screens

Simplicity Engineering Co., Durand, Mich.—Bulletin 67 details manufacturing methods and sizes and types of woven wire screen available for industrial applications such as scalping, feeding and conveying, sizing, separating and dewatering.

485. Portable Lifts

Oster Mfg. Co., Box 4326, Cleveland 32, O.—Catalog sheet illustrates and describes three models in a line of portable lifts.

486. Electrodes and Powders

National Carbon Co., Division of Union Carbide & Carbon Corp., 30 East 42nd St., New York 17, N. Y.—Catalog section A-4004 lists and describes a line of spectroscopic electrodes and powders engineered to meet every spectroscopic need.

487. Chain and Sprockets

Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill.—Book on precision roller chain and sprockets includes sections on stock drives, drive chain, conveyor chain, installation and maintenance, lubrication, sprocket wheels, casings and chain tighteners. Book reportedly contains all the information necessary to choose the right roller chain for a given application.

488. Flexible Pipe Nipples

Hauck Mfg. Co., 124-136 Tenth St., Brooklyn 15, N. Y.—Catalog 708B provides specifications and selection charts for flexible pipe nipples designed for strain-free connecting of air or gas lines to industrial oil or gas burners.

489. Diesel Lift Trucks

Hyster Co., 2902 North East Clackamas St., Portland 8, Oreg.—Forms 1331b, 1425 and 1465 present descriptions and engineering data on diesel-powered lift trucks with capacities ranging from 3000 to 20,000 lb.

490. Employee Communications

Clarkson Co., Kaukauna, Wis. — Booklet reproduces posters, bulletins and reminder tabs that make up a communications program aimed at control of wasted manpower and material.

491. Foundry Information

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.—Illustrated pocket-size booklet contains practical information concerning cupolas, electric furnaces and transformers, fuels, ladles, melting points, temperatures, weights and other foundry operations.

492. Medium Duty Brick

Ironton Fire Brick Co., Ironton, O. —A dense, tough, stiff mud refractory which has applications for brick-lined ladles and other foundry uses and a dry press brick used for general furnace construction are described in bulletin 105.

493. Aluminum Alloys

Apex Smelting Co., 2537 West Taylor St., Chicago 12, Ill.—Brochure provides the composition, typical mechanical properties and heat treatments of company's standard alloys.

494. Visualization Aids

Chart-Pak Inc., 100 Lincoln Ave., Stamford, Conn.—Catalog, "Visualization Made Easier," describes method of making organization flow charts,

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graphs and office and plant layouts. Pressure sensitive tapes and templates are preprinted on sheets with adhesive backing which can be mounted on plastic planning boards containing printed grid lines.

495. Welding Data

Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N. Y.—Pocket data book features simplified welding procedures for all base metals and covers 120 welding rods, electrodes and welding compounds. Book is written to serve as a guide to improved torch and metallic arc welding, brazing and soldering.

496. Oil-Gas Burners

Radiant Products Co., Box 729, Canton 2, O.—Size, capacity and engineering data on series of pulsation type oil-gas burners in six sizes providing a range of capacities from 72,000 to 70,000,000 Btu are offered in bulletin.

497. Solenoid Valves

Automatic Switch Co., 391 Lakeside Ave., Orange, N. J.—Engineering information, flow charts, operation and construction details, illustrations and prices of 2, 3 and 4-way solenoid valves are included in catalog 201.

498. Costable Refractories

Plibrico Co., 1800 Kingsbury St., Chicago 14, Ill.—Form 38 contains brief descriptions of 13 grades of castable refractory material with suggested uses for each grade.

499. Transometer

Askania Regulator Co., 240 East Ontario St., Chicago 11, Ill.—Ranges, specifications and performance data on transometer for metering fluids, oil and other liquids are in bulletin 301.

500. Axial Flow Fans

Detroit Blower Corp., 9867 Pacific Ave., Franklin Park, Ill.—Certified performance curves and specifications for line of aerodynamically designed axial flow fans are offered in bulletin DAF-101. Fan diameters are from 12 to 72 in. with air moving capacities from 1200 to 100,000 cfm.

501. Overhead Conveyors

Jervis B. Webb Co., Dept. NLP, 8951 Alpine Ave., Detroit 4, Mich.—Bulletin 954 illustrates and describes 10 typical industrial uses for a lightweight overhead conveyor. Advantages and complete specifications are included.

502. Resins

Polyrez Co., Woodbury, N. J.—Bulletin 23 covers properties of series of liquid and powder resins for foundry use. Bulletin also contains suggestions for curing some common foundry ills.

503. Skin Cleansers

Sugar Beet Products Co., 302 Waller St., Saginaw, Mich.—Information sheet describes line of skin cleansers and dispensers for industry and large commercial institutions.

504. Refractory Mortar

J. H. France Refractories Co., 1944 France Rd., Snow Shoe, Pa.—Service bulletin 610 presents manufacturer's use recommendations on a refractory mortar in laying up brick in heating applications and processing furnaces.

505. Electric Furnace Iron

Belle City Malleable Iron Co., Racine, Wis.—Folder 15 discusses the advantages of electric furnace iron for applications where a gray iron of precisely controlled properties is required.

506. Surface Markers

Markal Co., 3052 West Carroll Ave., Chicago 12, Ill.—Illustrated catalog gives information on use of markers for hot or cold surfaces, colors available and types of holders available.

FOUNDRY Reprints

507. Shell Molding

Shell Molding at Lynchburg, by Robert H. Herrmann, highlights a mechanized, high-production, jobbing shop making gray and ductile iron castings. The foundry is one of the first designed, built and operated solely to make shell mold castings.

508. Vacuum Degassing

Recent Developments in the CO_2 Process, by Dr. Waldemar Schumacher, is a review of recent CO_2 process developments with emphasis on gas evolution, collapsibility and thermal conductivity.

509. CO_2 Process

A Practical Method for Vacuum Degassing of Nonferrous Metals, by Harold F. Bishop, Edward E. Layne and William S. Pellini, discusses the application of vacuum degassing treatments that may be applied to practical foundry operation.

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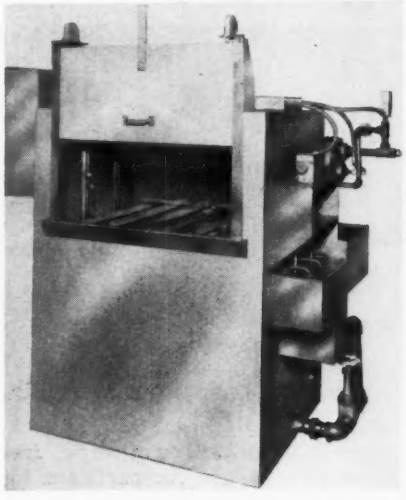
baskets of small parts each hour. Maximum overall size of each basket is 14 in. high x 14¾ in. wide x 21½ in. long. Baskets are loaded into the cabinet and door is closed to start



an automatic spray-clean, rinse and drain-dry sequence. Machine can be used as a single unit or in groups as required.

For More Details Circle No. 416—Page 201

Lifting Hooks

are pneumatically controlled and electrically operated

Gar-Bro Mfg. Co., 2415 East Washington Blvd., Los Angeles, Calif.—Pneumatically-controlled and electrically-operated lifting hooks can be operated by pushbutton from cab

of cranes. Jaws open wide to ease pickup but overlap in closing and reportedly cannot open under any load condition. Two sizes—6 and 12 ton capacities—are available. Hooks are of all-welded and reinforced construction.

For More Details Circle No. 417—Page 201

Solenoid Valve

is constructed to permit easy inspection and service

Airmatic Valve Inc., 7317 Associate Ave., Cleveland 9, O.—Construction of 2-way direct solenoid controlled valve provides easy inspection and service. All control parts can be removed without disturbing the piping by loosening one hexagonal nut. Primarily for alternating current pressure or vacuum applications, the valve is available in standard pipe sizes from ¼ through 2 in. Noncorrosive throughout, it can be controlled by a relay or a microswitch. It can be mounted in any position and operated continuously without harm to the valve or the solenoid.

For More Details Circle No. 418—Page 201

Recirculating Oven

is designed for analytical and general laboratory work

Blue M Electric Co., 138th & Chatham St., Blue Island, Ill.—Recirculating vertical air flow oven is designed for analytical and general laboratory work involving baking, drying, conditioning and preheating. Oven has visual indication of temperatures to 650° F. Units are shipped with all wiring complete, two adjustable shelves, neon pilot lights and two adjustable side exhaust vents.

For More Details Circle No. 419—Page 201

Spectrometer

reads wave lengths direct in Angstroms on a graduated drum

Ealing Corp., Box 90, Natick, Mass.—Spectrometer reads wavelengths direct in Angstroms on a graduated drum to 1A. Accurate readings can be made quickly by aligning the same bands of two readily visible reversed spectra. Instrument forms two spectra alongside each other, with the direction of their colors reversed. Spectra move across the field in opposite directions with the turn of a

micrometer screw. Readings are obtained by setting the line in one spectrum against the same line in the second spectrum. Drum is graduated from 3000 to 7000 A. Dispersion is 43 degrees.

For More Details Circle No. 420—Page 201

Fork Truck

is a side loader for working in aisles as narrow as 6 ft

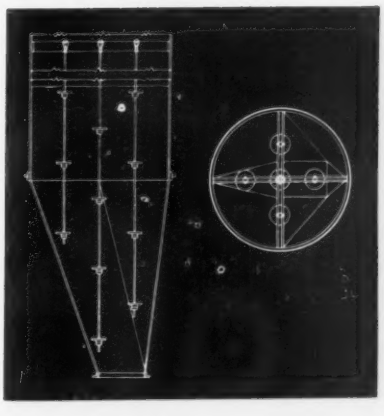
Baker-Raulang Co., 1223 West 80th St., Cleveland 2, O.—Heavy-duty fork lift truck uses the side loading principle to perform carrying and stacking operations in aisles as narrow as

Suspension Disks Aid Material Flow in Bins

CABLE SUSPENSION anti-bridging disks keep products free flowing in company's bulk storage bins. These disks are located strategically within the bin and, coupled with bin hopper design characteristics, aid material flow and prevent bridging. One side of the hopper is nearly perpendicular to the discharge while the other plane is a cone pitched to best accommodate the material being handled. Bins with these features are available in black iron, galvanized or stainless steel.

Bins are shipped in sections and require no field riveting or use of skilled labor for erection. Units are bolted together and capacity can be increased by adding extra sections. Bins are supplied in sizes from 3 to 14 ft in diam to 100 ft high. Fireproof and vermin proof, the bin walls cannot flake or contaminate material.

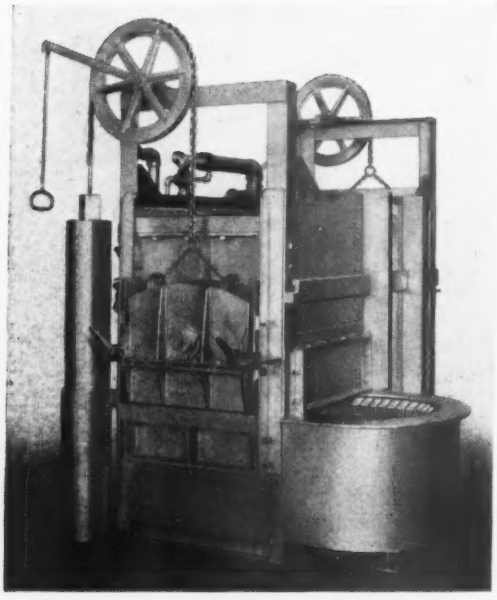
Heavy steel plate fins located on the hopper carry the load. Re-



inforced standing seam construction adds rigidity and strength to entire height of the body. Twin screw feeders, air lock rotary valves, rack and pinion gates or other discharge accessories are available. The storage bins are made by Day Co., 810 Third Ave., North East, Minneapolis 13, Minn.

For More Details Circle No. 442—Page 201

NEW JOHNSTON REVERBERATORY FURNACES!



★ Available in from 400 to 2,000 pound per hour capacities.

★ All parts exposed to flame or direct radiation are cast iron.

★ Automatic controls in breakdown and holding chambers.

★ Equipped with Johnston nozzle mixing burners.

★ Lined with top quality refractory brick.

★ Advanced design and quality workmanship throughout.

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• Melting Furnaces • Heating Torches • Ladle Heaters • Heat Treating Furnaces • Burners, Blowers, Controllers.

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2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.

ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

Circle 679 on Inquiry Card—Page 201

TERRE HAUTE SPECIAL FOUNDRY COKE

"...as you want it!"

• Only premium grades of coking coals go into it—the best the market affords.

• Full care to highest possible fixed carbon and shatter resistance. Low ash. Proper density and uniform cell structure.

• Result? You choose wisely and permanently when you specify Terre Haute special foundry coke.

SOLD EXCLUSIVELY BY

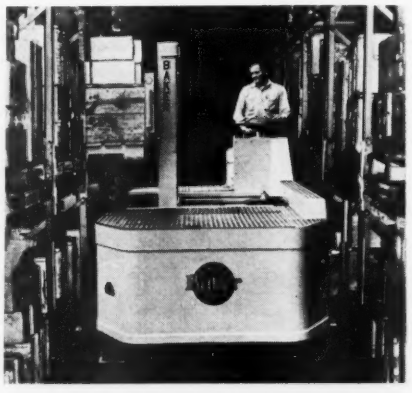
REPUBLIC COAL & COKE CO.
WILLOUGHBY TOWER, CHICAGO 3, ILLINOIS

Branches: Peoria • St. Louis • Indianapolis
Minneapolis • Cleveland • New York

Manufactured by: INDIANA GAS & CHEMICAL CORP.
Terre Haute, Indiana

Circle 680 on Inquiry Card—Page 201

6 ft. Of the standup rider type, the truck has full-size wheels, automotive type steering and hydraulic brakes. Other features and specifications include a 130-in. maximum lift, 31-fpm loaded lift speed, park-



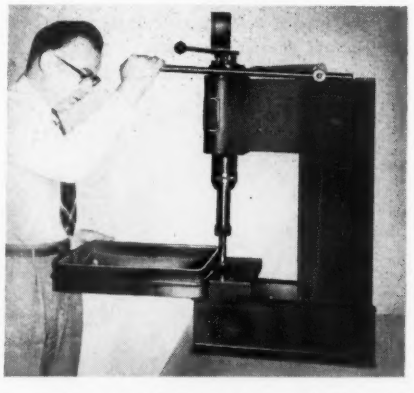
ing brake with pedal interlock, 5-degree tilt forward and back, free lift of 67½ in. and compartment for standard batteries up to and including 25.20 kwh.

For More Details Circle No. 421—Page 201

Bench Arbor Press

of 10 tons capacity can perform a variety of operations

K. R. Wilson Inc., Arcade, N. Y.—Bench arbor press of 10 tons capacity is engineered to perform blending, straightening, marking and punching



operations, including the replacing of bushings on molding flasks. Press features a release valve for "finger tip" ram control and a completely self-contained hydraulic cylinder. Specifications include hydraulic stroke of 6¾ in. and 12 in. maximum daylight.

For More Details Circle No. 422—Page 201

Compressors

are two-stage, double-acting, fully counterbalanced type

Atlas Copco Pacific Inc., 930 Brittan Ave., San Carlos, Calif.—Series of heavy duty air compressors are designed for foundry and manufacturing plant installations to provide

QUICK CHANGE WITH UNIVERSAL STANDARD PRESS-FIT FLASK PINS AND BUSHINGS

To compensate for wear in the ear holes of cope and drag, standard size Universal Press-Fit Flask Pins and Bushings are available with three different outside diameters, the second slightly larger than the original size and the third slightly larger than the second. Thus, as the ear holes increase in size—and replacement of the original pins and bushings becomes necessary—pins and bushings with a larger outside diameter are available to provide a good, tight fit in the larger ear holes without welding or other expensive, time-consuming operations. Just drive out the old, press in the new . . . truly "quick change"!

Universal Flask Pins and Bushings of all types are available in a complete range of sizes as regular stock items. Plain, taper, threaded or hexagonal series. For complete information, write to Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.

186

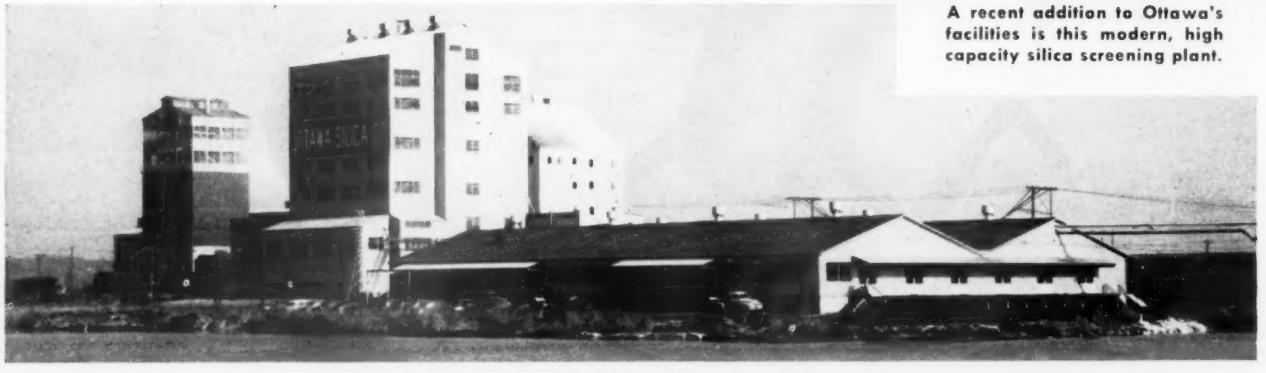
UNIVERSAL ENGINEERING COMPANY FRANKENMUTH 4, MICHIGAN

6500 tons of silica sand daily!

The LARGEST SINGLE operation of its kind in the United States

Ottawa's tremendous processing facilities are housed in two plants located on a 1000 acre quarry site of St. Peter's sandstone. This deposit rates as one of the purest and most extensive of its kind in the whole world. These huge mills house the most complete and modern refining processes in the industry and they operate around the clock to supply silica products to all corners of the earth.

A recent addition to Ottawa's facilities is this modern, high capacity silica screening plant.



A view of Ottawa Silica Company's Mill B, showing the new screening plant, grinding plant, portion of the original screening plant, warehouse and shop. The extensiveness of plant area and the most modern methods of sand processing make practically all grades of silica available for swift delivery. New plant additions in the past five years have resulted in a potential increase of 1500 tons of silica sand daily.

OTTAWA

SILICA SANDS

Serviced by two main trunk railway systems, Ottawa offers fast delivery to all corners of the nation.

99.89% PURE

Laboratory tests prove Ottawa Silica 99.89% pure.

Periodical improvements and plant additions are in line with a long established policy at Ottawa Silica Company. Constantly increasing industrial requirements for our fine silica sands have prompted this growth.

When you buy Ottawa silica you can be sure that you have bought the best available anywhere. Our policy also prescribes top product quality as well as ample facilities for providing prompt delivery.

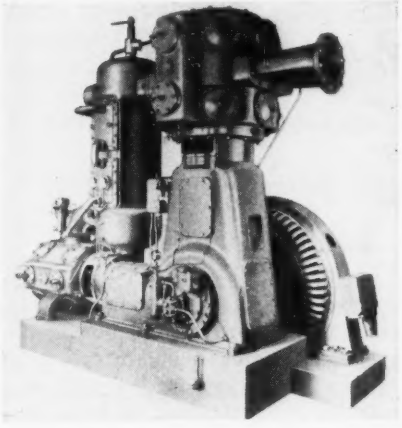
Get the habit of saying "Ottawa" when you buy silica. You'll be pleased with the product and the service.

OTTAWA SILICA COMPANY

PLANTS LOCATED IN
OTTAWA, ILL. AND ROCKWOOD, MICH.

SERVING THE FOUNDRY, GLASS AND CERAMIC INDUSTRIES FOR OVER 50 YEARS

air for operation of grinders, hoists and pneumatic tools. Six models, from 330 to 3220 cfm, are of the L-shaped, two-stage, double-acting, ful-



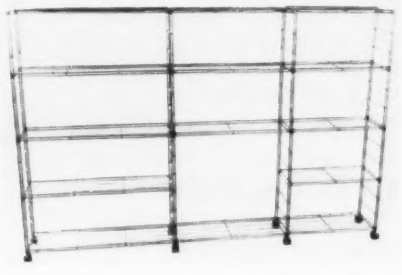
ly counterbalanced type. Standard type synchronous or induction motors may be used as the drive source.

For More Details Circle No. 423—Page 201

Steel Rod Shelving

is assembled without use of nuts, bolts or screws

Metropolitan Wire Goods Corp., 70 Washington St., Brooklyn 1, N. Y.—Steel rod shelving is assembled without nuts, bolts or screws. Notches are cut into heavy weight steel rod to close tolerances so that shelves and uprights are locked into place. Assembly is said to be a matter of minutes. Uprights are built so that shelves can be spaced at 5-in. in-



tervals. Shelves are supplied in 12 and 18-in. widths in 24, 36 and 48-in. lengths. Uprights are 51, 63, 75 and 87 in. A standard weight shelf, as distinguished from heavy duty, is also available.

For More Details Circle No. 424—Page 201

Drop Feed Oiler

is engineered to meet needs of high-speed, heavy load machines

Oil-Rite Corp., 2387 Waldo Blvd., Manitowoc, Wis.—Drop and flush oilers provide a way to automatically flood or flush a bearing with a definite amount of oil at the starting period, after which oil will feed drop

There's **BIG NEWS** in Resin Coated Sand . . .

- **SIMPLIFIED PROCEDURE**
- **FASTER PRODUCTION**
- **STRONGER SHELLS AND CORES**

. . . ECONOMY TOO!

Up to 30% greater cold strength, increased hot strength, less mulling time, shorter cycles . . . these are *just a few* of the advantages being obtained in mass production of shell molds and cores—dumped or blown—with the new Durez 18250 resin.

The whole story is in our 16-page "Durez Guide to Resin Coated Sand". Coating method, solvents, test methods—everything is discussed in clear, complete detail. Send for your free copy today . . . and order a trial shipment of Durez 18250.

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FREE COPY

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HOOKER ELECTROCHEMICAL COMPANY
1008 Walck Road, North Tonawanda, N. Y.

Send me, free and without obligation, your "Guide to Resin Coated Sand".

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Position _____

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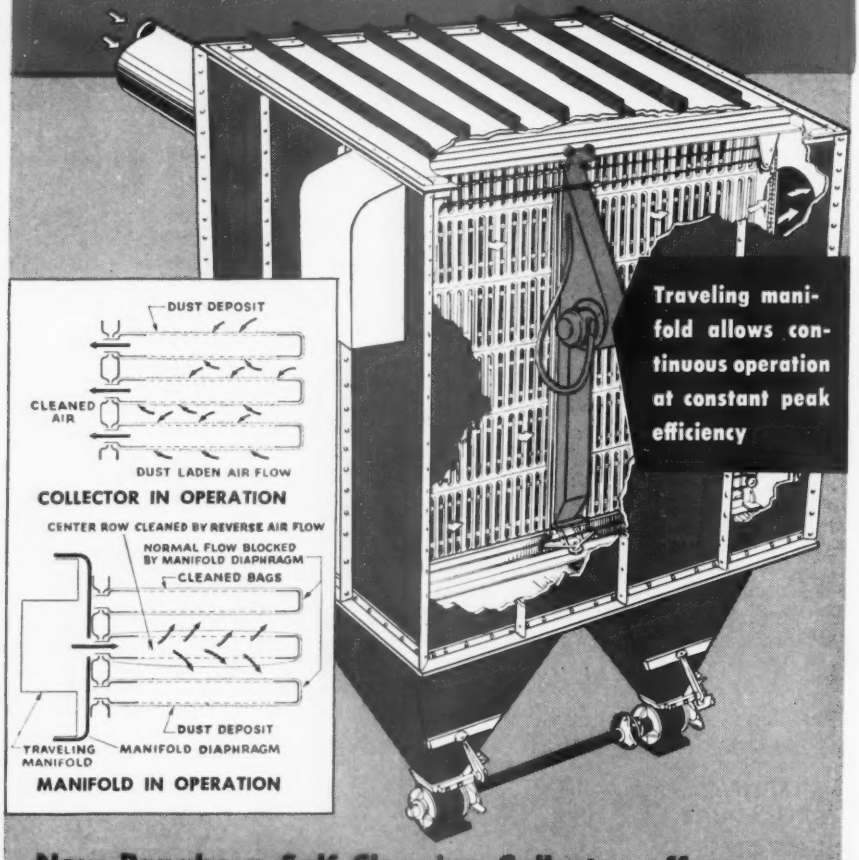
HOOKER® CHEMICALS PLASTICS

Export Agent: Omni Products Corp., 460 Fourth Avenue, New York 16, New York

Circle 683 on Inquiry Card—Page 201

NOW! Great news about a NEW Pangborn Dust Collector that MAINTAINS CONSTANT OPERATING EFFICIENCY



New Pangborn Self-Cleaning Collector offers continuous automatic operation, constant air volume and suction, uniform air flow resistance at low cost.

TO MAINTAIN constant efficiency, the Pangborn Self-Cleaning Collector combines the proved efficiency of the cloth screen collector with continuous automatic operation.

A manifold with integral blower slowly traverses the clean air outlets of the screen frames. Covering three rows of screens at any given time, it applies a reverse air current through the center row to remove collected dust from the cloth surfaces. The result is constant high collecting efficiency and continuous operation—shutdown of the system for periodic cleaning is eliminated. Because of design simplicity and unit construction, this unique collector requires lower initial, operating and maintenance costs as well as less floor space than comparable collectors.

For full details, write for Bulletin 915 to PANGBORN CORP., 1400 Pangborn Blvd., Hagerstown, Md.

4D

Pangborn CONTROLS DUST

Circle 684 on Inquiry Card—Page 201

by drop. Amount of oil provided for flushing is fixed while drop feeding can be adjusted. Transparent reservoirs permit visual check of oil supply. Lucite reservoirs are suggested for temperatures below 160°F. Glass reservoirs are available for temperatures above 160°F. Capacities from 9 oz to 1 gal can be supplied.

For More Details Circle No. 425—Page 201

Light Reflector

gives increased uplight from mercury lamps in high bays

Jones Metal Products Co., Abolite Lighting Division, West Lafayette, O.—Aluminum light reflector is designed to increase uplight in high

bays when using color-corrected mercury vapor lamps. Open top design is said to provide 16 to 18 per cent uplight in maintaining balance of light between lamp and ceiling. Either socket-reflector or separable-socket (disconnecting) mounting types are available.

For More Details Circle No. 426—Page 201

Wet Cutting Blades

are designed for cutting fire clay refractories

Clipper Mfg. Co., 2800 Warwick, Suite 645, Kansas City, Mo.—Wet cutting abrasive blades are designed for cutting fire clay refractories or products of similar composition. The blades are an addition to company's line of wet cutting abrasive blades to provide a broader selection of specifications for all types of materials.

For More Details Circle No. 427—Page 201

Hand Lift Truck

of straddle type can handle short-haul loads up to 2500 lb

Market Forge Co., 35 Garvey St., Everett 49, Mass.—Straddle hand lift truck is designed to accommodate loads up to 2500 lb for short

New
PAYLOADER®
Model HAH

Bucket Capacity — 1cu. yd.
Lifting Capacity — 4,000 lbs.
Carry Capacity — 3,000 lbs.
Breakout Force — 4,500 lbs.
Torque Converter Drive
Power Steer

Which best fits your needs?

New
PAYLOADER®
Model HA

Bucket Capacity — 18 cu. ft.
Lifting Capacity — 3,000 lbs.
Carry Capacity — 2,000 lbs.
Breakout Force — 3,000 lbs.
Torque Converter Drive

Now, Hough, the pioneer and leader in the tractor-shovel industry, gives you a choice of two new, more productive "PAYLOADER" units. Both have front-wheel-drive and rear-wheel-steer — especially designed for stockpile work and fast material moving in close quarters. They're the finest of their type in Hough history — they're both way ahead of the field in design, performance and all-round value.

FEATURES of these outstanding new models include: 40° bucket tip-back at ground; torque converter drive; full-reversing transmissions; closed, pressure-controlled hydraulic system; large hydraulic brakes; accumulator in hydraulic system that prevents pressure shocks and facilitates bucket control; power steer on model HAH.

Your nearby "PAYLOADER" Distributor is eager to show what these new machines can do for you.

Use the coupon below to get full information on any "PAYLOADER" model

SAY "HUFF"

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
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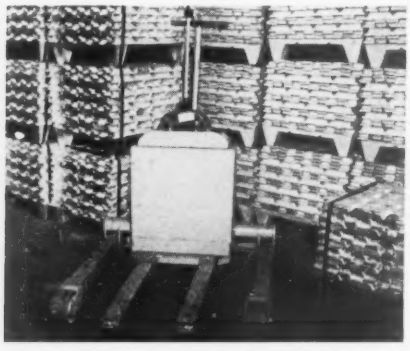
THE FRANK G. HOUGH CO. • 703 SUNNYSIDE AVENUE • LIBERTYVILLE, ILLINOIS

Send data on "PAYLOADER" units Model HA ☐ Model HAH ☐ larger sizes ☐

Name ..... Title ..... Firm .....

Street ..... City ..... State .....

hauls and load maneuvering to free power fork trucks for other work. Width is 37½ in. Distance between wheel fork members, in-to-in, 29 in. Fork lengths are 30 in. Lift range is



4 in. Base wheels are 6 in. in diam with a 3-in. face. Steering wheels are 10 in. in diam with a 3-in. face.

For More Details Circle No. 428—Page 201

Patching Material

has high magnesia content and rapid-setting properties

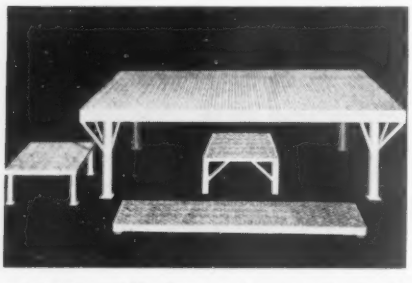
Kaiser Chemicals Division, Kaiser Aluminum & Chemical Sales Inc., 1924 Broadway, Oakland 12, Calif.—Basic refractory patching material is a high magnesia content material sized to meet patching requirements and has a chemical bond that sets rapidly and provides high strength. According to the manufacturer, the material offers the desirable periclase qualities of high electrical resistance, ability to absorb several times its own weight of iron oxide, acquired toughness and long life.

For More Details Circle No. 429—Page 201

Safety Grating

is included in new series of products for industry

Kniep Associates, Grist Mill Rd., Dover, N. J.—Company is adding a series of heavy-duty products, including safety-tread work platforms, stairs, dock boards and floor racks, to its standard line of safety grating



products. All the equipment is built to customer's specifications and is said to provide industry with safety devices not covered by standard safety grating equipment.

For More Details Circle No. 430—Page 201

Cold Process Roofing

eliminates need to remove old roofs before starting build-up

Monroe Co., 10703 Quebec Ave., Cleveland 6, O.—Roof repair method eliminates necessity of removing old roofs before work can be begun on new built-up roofs, and also does away with heating of the roof coating, hot mop applications and the use of gravel. Materials used are an adhesive sealing cement, heavy duty roofing felt and a silicone-treated asbestos coating.

For More Details Circle No. 431—Page 201

Air Control Valve

improves efficiency of exhaust systems and dust collectors

Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11, O.—Air control valve is for increasing the efficiency of air suction systems and dust collectors. Valve operates automatically,

concentrating the suction of the collector only at machines in operation and presents an unobstructed passage for the air stream when open, eliminating clogging. Valve may be installed in any position. Available in 110, 220 and 440-v models, it is designed to accommodate 3 to 8-in. openings.

For More Details Circle No. 432—Page 201

Vacuum Cleaner

cleans wet or dry surfaces and can be used as a blower

Black & Decker Mfg. Co., Towson, Md.—Industrial vacuum cleaner for cleaning wet or dry surfaces can hold 3¾ gal of liquid or ⅞ bu of dry material before emptying is necessary. Cleaner is powered by a 1¼-hp motor. Two 8 in. rubber wheels and a caster in front permit easy rolling as well as stability when moving over rough floors. A locking device on the caster holds machine stationary when desired. By changing hose connections, the unit can be converted to a blower.

For More Details Circle No. 433—Page 201

Fire Extinguisher

is designed to snuff out all kinds of industrial fires

Tetco Co., 3350 San Fernando Rd., Los Angeles, Calif.—Fire extinguisher uses chlorobromomethane to snuff out all kinds of fires, including

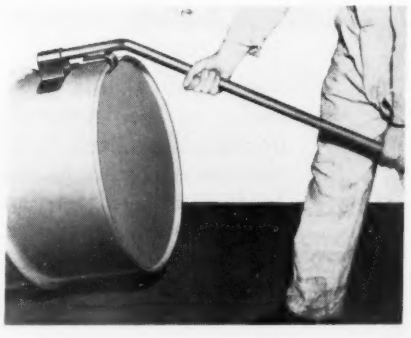
grease, oil or gasoline. Units come charged with 120 lb of CO_2 to shoot a mist of chlorobromomethane up to 18 ft. Container fits the hand and is delivered with a hook for hanging. A standard and a large unit are made.

For More Details Circle No. 434—Page 201

Drum Upender

handles heavy drums with a minimum of effort

Morse Mfg. Co., 727 Manlius St., East Syracuse 2, N. Y.—Drum upender has a 40-in. handle, offset 35 degrees for maximum efficiency in raising drums from horizontal to



vertical. A 1¼ in. hook provides clearance for the largest chime. A 2½ x 8-in. toe plate spreads lifting pressure over a wide area to prevent drum damage. Tool is designed for manually upending heavy drums.

For More Details Circle No. 435—Page 201

Strand Wire Rope

offers increased strength over company's round ropes

H. K. Porter Co., Leschen Wire Rope Div., 2727 Hamilton Ave., St. Louis 12, Mo. — Flattened strand

In This Leading Automotive Foundry, 500 to 600 tons of iron go through each of the big receiving ladles daily. A rammed lining of Norton ALUNDUM refractory cement, six inches thick, lasts 10 to 12 weeks, handling an average of 15,000 tons. Only occasional patching is required. The two-ton Crane monorail ladles handle 240 tons per day. Their linings of ALUNDUM cement, four inches thick, average 54 days of service life for a total tonnage of 13,000. About half these smaller ladles require patching, with the same Norton refractory material, after an average of 36 days' service.

Can your linings take this punishment?

Proof that ALUNDUM cement gives long life under heavy duty*

Another Tough Spot for linings is this trough, in the same big automotive foundry. From 500 to 600 tons of molten iron pour through the trough every day. Bottom and sides, from dam to trough end, are lined with ALUNDUM cement. Average lining life is 11 to 12 days, during which approximately 6,000 tons of iron passes through.

High-melting, long-lasting ALUNDUM cement is just one of many Norton ℞'s — refractories *engineered and prescribed* for longer, lower cost service across the range of furnace applications. Others include CRYSTOLON*, MAGNORITE*, and FUSED STABILIZED ZIRCONIA.

For ℞'s that will help maintain hot metal schedules and reduce shut-downs in your own furnaces, call in your Norton Refractories Engineer. Or write to NORTON COMPANY, 307 New Bond St., Worcester 6, Mass. *In Canada:* A. P. Green Fire Brick Co., Ltd., Toronto 5, Ontario.

NORTON

REFRACTORIES

Engineered... ℞... Prescribed

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives Sharpening Stones • Behr-cat Tapes
***Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries**

Circle 686 on Inquiry Card—Page 201

7 things to remember about BLASTRITE SHOT AND GRIT

QUALITY
EFFICIENCY
ECONOMY
LONG WEAR
CAREFUL SCREENING
PROPER ALLOYING
LABORATORY CONTROL

AVAILABLE IN ALL SIZES

Ask for our new catalog No. AB-53

ABRASIVE SHOT & GRIT CO., INC.
SPRINGVILLE, N.Y.
Telephone Springville 1

wire rope reportedly offers increased strength over company's round strand ropes. Added strength permits greater than normal temporary loads to be handled without need to install a larger rope, change sheaves or make other equipment changes. Rope is said to have high resistance to fatigue, abrasion, crushing and shock.

For More Details Circle No. 436—Page 201

Electric Fork Trucks

feature compact construction with minimum turning radii

Lewis-Shepard Products Inc., Dept. R-20, Watertown, Mass.—Rider type electric fork trucks in 1500, 2000, 3000 and 4000-lb capacities feature compact construction with minimum turning radii. The trucks will right angle stack 40-in.-long loads in aisles 114⅝-in. wide and 48-in.-long loads in aisles 120⅝-in. wide. Turning radius is 62¼ in. With 36-in.-long forks, overall truck length is 110⅝ in. and width is 36 in. Lift height for an 83-in. collapsed height is 132 in. on 1500 and 2000-lb trucks and 130 in. on 3000 and 4000 lb models. Mast tilts in 10 degrees and out 3 degrees.

For More Details Circle No. 437—Page 201

Layout Templets

adhere to any nonporous surface until they are removed

Planoramics, 631 East First St., Boston 27, Mass.—Symbols and figures of plastic material for use in drafting and layout problems require no glue, paste or adhesive to make them stick. When used with office and furniture layout kits they can be used repeatedly for making charts and layout plans. Templets eliminate drawings and erasures, allow for instantaneous changes and can be photostated or contact printed as a finished plan without further drafting.

For More Details Circle No. 438—Page 201

Axial Roof Ventilator

uses hollow airfoil blades to improve exhaust efficiency

Detroit Blower Corp., 1967 Pacific Ave., Franklin Park, Ill.—Industrial roof ventilator uses hollow, die-formed airfoil fan blades to improve exhaust efficiency and allow low wheel tip speeds to reduce noise and consume minimum power. Blade diameters range from 9 to 48 in. Motor-fan outputs are capable of exhausting 350 to 34,430 cfm of fumes, smoke and dust, according to the manufacturer.

For More Details Circle No. 439—Page 201

first choice
FOR GREATER
- accuracy
- uniformity
- economy
- service

SCIENTIFIC MATCH PLATES
Pressure Cast

- Molded in plaster for extreme accuracy
- Poured under pressure to fill all detail
- Backed by a 19-year reputation for quality and service

"Ask the man who's used them."

The SCIENTIFIC CAST PRODUCTS Corp.

1390 East 40th St., Cleveland 3, Ohio
2520 West Lake Street, Chicago 12, Ill.

Circle 687 on Inquiry Card—Page 201
Circle 688 on Inquiry Card—Page 201

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FOUNDRY

SCIENTIFICALLY DEVELOPED . . LABORATORY CONTROLLED FOUNDRY PRODUCTS

FOR STEEL . . GRAY IRON MALLEABLE AND NON-FERROUS

DELTA SUPERKOAT WASH

COVERS A GREATER SURFACE AREA . . PRODUCES SMOOTHER . . CLEANER CASTINGS . . . *at lower cost!*

Delta Superkoat Wash is recommended for Steel, Gray Iron, Malleable and Non-Ferrous castings. It's easy to mix and apply uniformly to green or dry sand and baked surfaces by dipping, swabbing, spraying or brushing.

NOTE THESE IMPORTANT ADVANTAGES OF DELTA SUPERKOAT WASH:

1. **NO PRECIPITATION OR SETTLING —** When thoroughly mixed, wash will stay in suspension indefinitely.
2. **EASY TO APPLY —** It can be dipped, swabbed, brushed or sprayed on green or dry sand and baked surfaces.
3. **RAPID, DEEP PENETRATION AND EXCELLENT ADHESION** Quickly anchors itself 5 to 7 grains deep in sand surfaces.
4. **NON-REACTIVE — LOW GAS —** Will not react or produce gas in contact with molten metal.
5. **REDUCED CLEANING COSTS —** Cast surfaces are smoother and castings are cleaner.
6. **WILL NOT FLAKE —** When completely dried, the wash is thoroughly bonded to the sand surfaces.
7. **HIGHLY REFRACTORY —** Has an unusually high fusion point.
8. **ELIMINATES SAND FUSION AND BURN-IN —** Flowing metal will not crack or rupture wash during pouring.
9. **ECONOMICAL TO USE —** Covers a greater surface at a lower cost per pound of wash.

Working samples and complete literature on Delta Foundry Products will be sent to you on request for test purposes in your own foundry.

DELTA

DELTA OIL PRODUCTS CO.

MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

MILWAUKEE 9, WISCONSIN

Obituary

PLUMB T. BANCROFT, 89 former foundry superintendent, John Deere Harvester Works, East Moline, Ill., died May 14. For many years he was engaged in the building of electric locomotives in railroad shops throughout the country. In 1909 he became a foreman with Deere & Co., Moline, Ill., and in 1920 took charge of the foundry of John Deere Harvester Co., where he was superintendent until he retired about 1935. He was voted a life membership in the American Foundrymen's Society in 1935 and served as chairman of the Quad-City Chapter of the AFS in 1937-38.

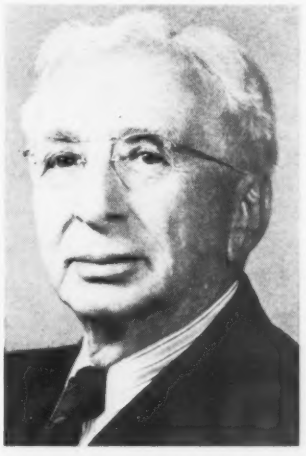
Leo J. Gardner, 43, manufacturers' representative, died June 15. With headquarters in Cleveland he covered part of Ohio and western Pennsylvania for National Crucible Co., Philadelphia; Newaygo Engineering Co., Newaygo, Mich.; Foundry Flask Division, Black, Sivalls & Bryson Inc., Kansas City, Mo.; and Fremont Flask Co., Fremont, O. He was formerly associated with Harsch Bronze Foundry, Cleveland, and the Williamsport, Pa., division, Avco Corp., New York.

Dr. Charles R. Austin, 58, assistant to the president, Meehanite Metal Corp., New Rochelle, N. Y., died May 31. He joined the company in 1945

DR. CHARLES R. AUSTIN

as director of research. Born in Manchester, England, Dr. Austin was a Fellow of the Royal Institute of Chemistry of Great Britain and subsequent to his association with the National Physical Laboratories of London, he was in charge of metallurgical research for the National Tube Co., Pittsburgh. In 1934 he joined the teaching staff of Pennsylvania State College where he developed and directed a co-operative program of research in metallurgy in association with several well-known steel companies and allied metallurgical industries.

August N. Farmer, 84, one of the founders and treasurer of Sand Products Corp., Cleveland, died June 23. Mr. Farmer was a teacher, principal and school superintendent until



AUGUST N. FARMER

1925 when he helped found the sand company which mines sand and ships it to foundries in the Great Lakes area. His son, Sterling N. Farmer, is vice president of the company.

John J. Cleary, 66, vice president of sales and service, Sand Products Corp., Cleveland, died June 14. He joined the company in 1929. Previously Mr. Cleary was associated with Forest City Foundries Co., Cleveland, the Buffalo plant of American Radiator & Standard Sanitary Corp., New York, and other companies.

Joseph C. Sanders, 79, former president, American Foundry & Mfg. Co., St. Louis, died July 3. He was president and chairman of the board of the company from 1917 until he retired in 1947.

Walter J. Bennett, sales manager, Canton Chaplet & Mfg. Co., Canton, O., died May 24. Associated with the foundry industry for 30 years, Mr. Bennett joined Canton Chaplet in 1952.

Norman C. Robinson, vice president, Atlas Brass Foundry, Los Angeles, died June 6.

NORTH AMERICAN REFRACTORIES CO.
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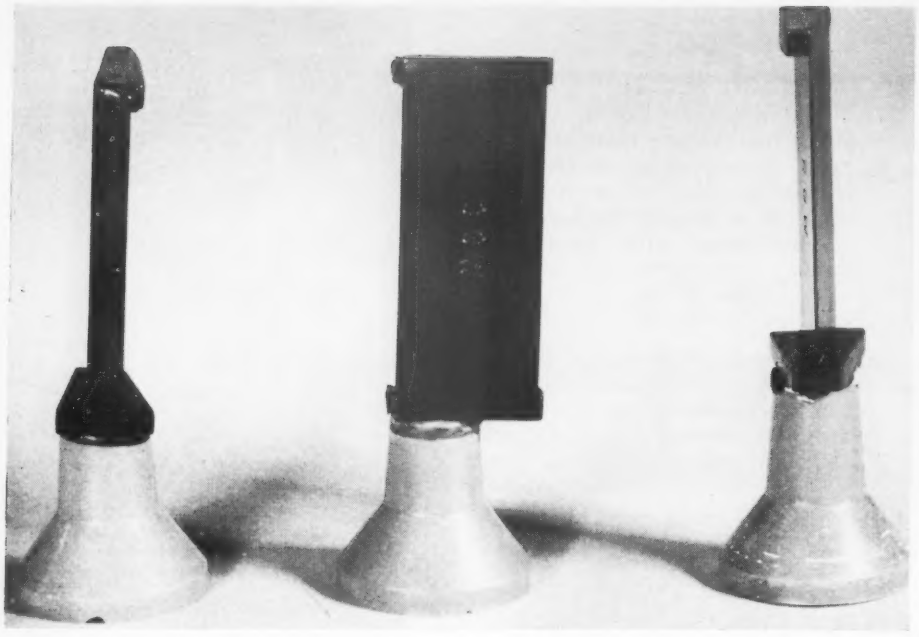
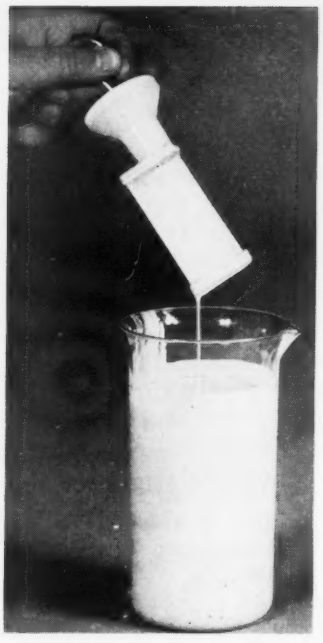
Circle 691 on Inquiry Card—Page 201



Disposable wax patterns have thin trailing edges. Mold reproduces the wax surface finish precisely



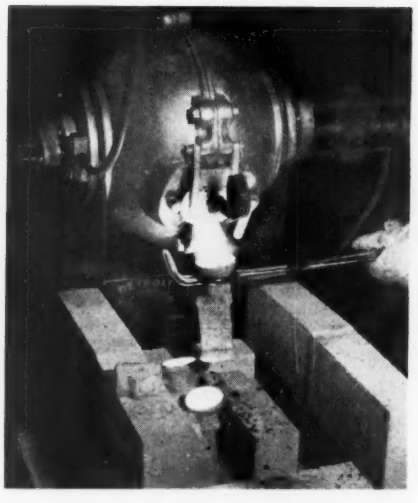
First step is to dip wax pattern into slurry of Glascast. Additives insure adhesiveness

New Molding Process Uses Glass Shell Molds

A TECHNIQUE for making accurate shell molds for casting close-tolerance parts of high-temperature alloys has been developed by the Corning Glass Works, Corning, N. Y. Using one-piece glass powder molds, the Glascast process is said to provide castings with excellent surface finish, fine definition and precision. Production cycle is relatively short — from pattern to casting in less than one day.

Lightweight molds are made by dipping a wax pattern into a Glascast slurry, coating it with coarser Glascast grains and, after drying the assembly, dipping and coating it several times to build up the mold shell thickness. The assembly is fired for a short time to remove the wax pattern.

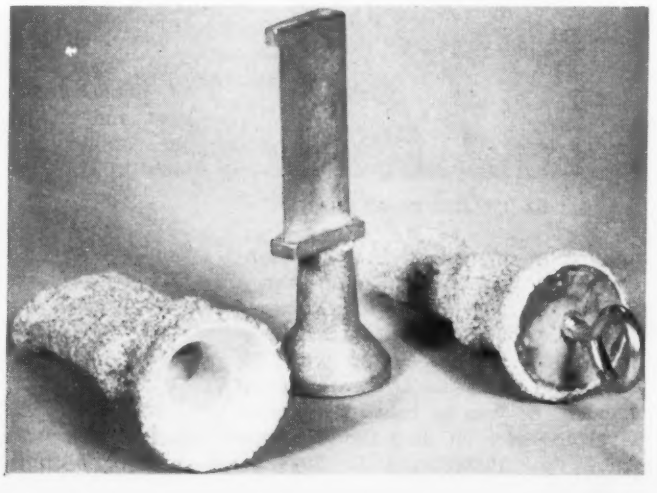
The mold at this point is ready for



Molds can withstand pouring temperatures to 3300°F, need no backing

Before slurry dries on the wax pattern, the assembly is coated with coarse Glascast grains. It is dried at room temperature, dipped and recoated

Center—Casting has high surface finish and close dimensional control. *Right*—Mold assemb'y before firing and dewaxing. *Left*—Assembly after firing



casting without additional treatment.

Low thermal expansion of the mold material—a 96 per cent silica glass powder—assures tight dimensional control. Low dimensional change and absence of firing shrinkage in the molds enable accurate calculation of metal expansion. Molds can withstand pouring temperatures up to 3500° F with tolerances of ±0.005 in. per in. obtainable.

The mold shell ranges from ⅛ to ¼-in. thick and assures rapid cooling to control grain size. Metal contraction after casting causes the noncontracting mold to crack off, freeing the casting of adhering ceramic material and eliminating knockout time and equipment.

The Glascast mold has excellent resistance to thermal shock, and metal alloys with high melting points may be poured into a cold mold without fear of its cracking, although preheating is recommended. Coefficient of expansion of the material is reported as 0.00000047 in. per in. per degree F between 0° and 587° F.

Equipment needs for the process are basic: Mixing containers, high-speed propeller mixers, rollers, stoppered bottles, dipping troughs, grain coating boxes and a furnace capable of 2000° F temperatures. Regular lost wax pattern dies are used for the patterns.

The slurry is prepared by mixing Glascast powder into water, stirring and placing it into bottles. Binding and adhesive agents are added to the slurry and the bottles are stoppered and set on rollers for a mixing period of 8 to 12 hr. Viscosity of the slurry using a Zahn No. 4 viscosimeter, should be 29 seconds.

The first dip of the wax pattern into the slurry is dried by ammonia for three minutes and then dipped again. While still wet, it is coated with coarser Glascast grains and dried again. This dipping, grain-coat-

"My gosh—they're firing shot and grit!"

For protection in the foundry...

JAXCOLITE!*

We don't imagine there has ever been a safety material devised that is so right for foundry use as Jaxcolite-coated asbestos, duck or burlap.

Jaxcolite is a new compound. It has been thoroughly tested, proved and approved. Applied to the materials mentioned above, *it provides exceptional* resistance to molten metal splash, to heat, to burn, to the strongest acids and caustics, and of course to oil and water. Yet it wears well, it is flexible, lightweight and comfortable. Its cost is low. And the amazing thing is that people who use it simply refuse to buy anything else.

Steel-Grip makes a complete line of safety apparel made from Jaxcolite materials. The list is shown on this page. We earnestly urge you to send for trial swatches of this material and make any tests you want. It may prove to be *THE* answer to safety problems long unsolved. Send today.

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TO BE SURE OF THE GENUINE, DEMAND THIS TRADE-MARK

1. Amazing Jaxcolite Coated Materials are made up into Steel-Grip guaranteed quality safety apparel, VIZ:

Coats	Sleeves
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Aprons	Spats

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Send for trial garment and prove its superiority for yourself.

2. *We manufacture a complete line of safety apparel for every need, in leather, duck, Perma-Proof materials, asbestos, wool, Dynel cloth, Jaxcolite coated materials, aluminum coated materials, etc. These garments reflect in their materials, design and manufacture the high quality standards that have made Steel-Grip the outstanding supplier in the United States. Write for a catalog.*

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ing cycle is repeated five or six times, depending upon slurry viscosity. After the final dip and coating, the assembly is dried for several hours at room temperature and is ready to be fired. Without use of drying agents, the assembly will dry in eight hours.

A special dewaxing-firing furnace is recommended, although degreasing will also dissolve the wax. The furnace is a standard top-loading furnace with a removable bottom, capable of temperatures to 2200° F. When temperature has reached 1920° F, the inverted mold is inserted and the bottom of the furnace pulled out. Low thermal expansion of Glascast makes flash firing at high temperatures possible. The wax, hit suddenly by this high temperature, melts from the mold without expanding or burning and falls through the furnace to a container. Furnace bottom is replaced and the mold is fired. For single unit molds, the dewaxing and firing cycle takes 10 to 15 minutes.

This type furnace eliminates virtually all wax combustion and fumes and completely removes all wax from the mold. If any wax remains it is burned off in the furnace.

The technique is said to be suitable for any casting method (static, pressure, centrifugal, vacuum) and can be used in casting metals such as Stellite, Rexalloy, X-40 alloys, J-alloys, stainless steels and aluminum alloys.

Industrial Heating Equipment Men Discuss Heat Treating

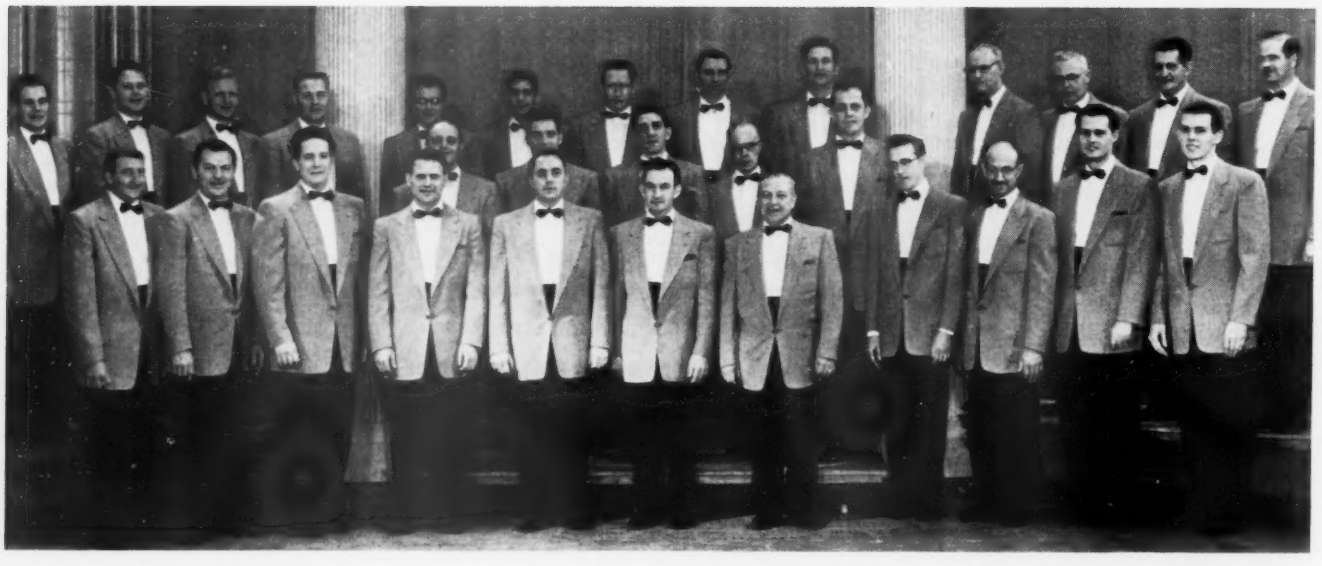
Numerous activities of interest to the metalworking industry were undertaken by the Industrial Heating Equipment Association at its annual spring meeting at the Homestead, Hot Springs, Va., May 20-23.

By unanimous vote, the association adopted an "interpretation" of J. I. C. standards for heat treating equipment which was drafted by a group of its technical experts.

Plans also were announced for a special seminar on heat treating to be held in connection with the National Metal Congress, to be sponsored in Cleveland Oct. 8-12 by the American Society for Metals. Experts from IHEA member companies have prepared a two-and-a-half-hour session on the latest information on the use of protective atmospheres in heat treating. The session will be divided into three parts covering selection and application, control and safe operation of furnace atmospheres.

An association committee has been formed to study the development of a suitable measure for escalation of contracts where equipment has a long-term production cycle. Chairman is Horace Drever, Drever Co., Philadelphia. To explore further the need for an index for escalation of contracts, the group heard Jesse M. Cutts, chief, Branch of Industrial Prices, Bureau of Labor Statistics, discuss "Price Indexes and Escalation." The association voted unanimously to co-operate with the Bureau to establish an accurate and representative price index.

MALE GLEE CLUB IS PRIDE OF BELLE CITY MALLEABLE



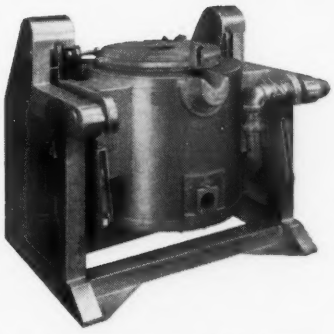
TEN YEARS ago, a male glee club was organized as a recreational activity at Belle City Malleable Iron Co., Racine, Wis. The voices belonged to the kind of men who had a wonderful time at a party if they were off in a corner harmonizing. Not one of them would have considered getting up in front of a group to sing a solo.

But these were brave foundrymen, and the director, Ralph Houghton, was made of stern stuff. The voices were sorted into their proper ranges, and the following spring the group put on the first of nine self-authored and costumed productions for employees and their families.

This season, the boys scored a first among Racine industrial choruses by appearing on WTMJ-TV, Racine, as guests on the "Wisconsin House Party." Other high lights of its activity include entertaining at a banquet given for members of the Malleable Founders' Society at the Edgewater Beach Hotel, Chicago, and a concert for visiting representatives at the state convention of the General Federation of Women's Clubs.

They also have been guest artists at many business, social and charitable functions, including traditional Christmas caroling for shut-ins. They won the Southeastern Wisconsin Music Festival contest and have been leading contenders in the annual Chicagoland Music Festival.

The Belle City Malleable Iron Co. Glee Club is a real illustration of Americanism at work. Members meet voluntarily once a week to practice on their own time. Their membership includes all types of employees—from accountant to foreman, inspector and truck driver—singing side by side, achieving harmony in human relations as well as in music.



Lindberg-Fisher type MNP nose-pour tilting crucible furnace. Pouring lip is located in the axis of tilting providing a constant pouring arc regardless of degree of furnace tilt. Capacities up to #800 crucible with brass, up to #1000 crucible with aluminum. Oil or gas fired. Described in Bulletin 57-A.

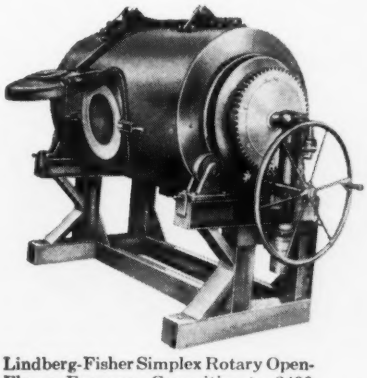
Lindberg-Fisher Electric Resistance Melting and Holding Furnace equipped with heavy duty resistance elements which give uniform distribution of heat, insuring long element and pot life. Capacities 250 to #1000 crucible.

For Non-Ferrous Metals

A complete line of

LINDBERG FISHER

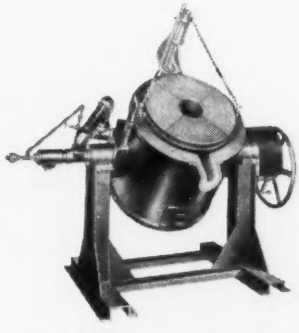
MELTING AND HOLDING FURNACES



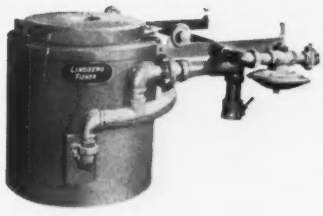
Lindberg-Fisher Simplex Rotary Open-Flame Furnace. Capacities to 2400 lbs. aluminum. 6000 lbs. brass. Oil or gas fired. Described in Bulletin 29-A.

For Melting Aluminum • brass • yellow brass bronze • copper • copper nickel alloys • lead magnesium • nickel • tin • zinc.

Because Lindberg-Fisher builds *all* kinds of melting equipment . . . gas . . . oil . . . electric . . . induction, and Carbon arc . . . L-F engineers are able to recommend, without prejudice, the proper type of furnace for *your* particular melting requirements.



Lindberg-Fisher type BB1 Hand-Tilt Crucible Furnace. Tilting mechanism consists of a hand wheel, driven through machined worm gear and pinion reducing gears. Capacities 50 to #400 crucible. Oil or gas fired. Described in Bulletin 400.



Lindberg-Fisher type SF stationary crucible furnace features rapid melting and is recommended for general foundry casting work. Capacities 30 to #400 crucible. Oil or gas fired. Described in Bulletin 301.

Melting specialists for 25 years

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This modern factory — The Toledo Steel Shot Division — will be devoted to the production of a brand new steel shot, Toledo REALSTEEL — the newest member in our complete line of 20th Century quality shot and grit.

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Foundry Statistics

ALUMINUM

(Shipments of castings—1000 pounds[1])

	Shipments				Unfilled Orders[2]
	Total	Sand	Perm. Mold	Die	
1954	624,973	158,473	214,408	245,291	.....
1955					
Apr.	73,049	14,041	28,028	30,208	109,156
4 mo.	283,290	56,997	105,055	118,490	.....
May	71,691	14,235	25,597	31,243	104,984
June	68,473	14,920	24,682	27,939	102,799
July	55,033	11,716	21,006	21,656	101,024
Aug.	64,861	14,916	22,267	27,004	105,994
Sept.	67,069	14,769	23,075	28,532	111,696
Oct.	72,197	14,485	25,135	31,741	120,222
Nov.	75,065	14,327	26,267	33,852	126,954
Dec.	75,275	15,291	25,031	34,347	123,363
Total	832,957	171,656	298,115	354,804	.....
1956					
Jan.	74,152	15,861	24,528	33,253	121,924
Feb.	73,096	15,560	23,963	32,949	115,958
Mar.	73,785	16,597	22,816	33,965	110,642
Apr.	67,880	14,732	20,718	31,782	106,477
4 mo.	288,913	62,750	92,025	131,949	.....

MALLEABLE IRON

(Shipments of castings—net tons[1])

	Shipments		Standard		Pearlitic		Unfilled Orders[2]
	Total	For Sale	Total	For Sale	Total	For Sale	
1954	812,016	461,982	.....	.....	.....	.....	.....
1955							
Apr.	101,226	57,397	.....	.....	.....	.....	104,091
4 mo.	371,597	214,181	.....	.....	.....	.....	.....
May	98,397	57,317	.....	.....	.....	.....	106,446
June	99,456	60,261	.....	.....	.....	.....	107,559
July	75,570	44,914	.....	.....	.....	.....	115,420
Aug.	82,448	48,126	.....	.....	.....	.....	123,473
Sept.	87,215	55,471	.....	.....	.....	.....	116,636
Oct.	90,866	53,804	.....	.....	.....	.....	121,261
Nov.	99,280	58,069	.....	.....	.....	.....	116,981
Dec.	99,946	60,409	.....	.....	.....	.....	123,107
Total	1,104,775	652,552	.....	.....	.....	.....	.....
1956							
Jan.	93,562	54,618	79,406	45,747	14,156	8,871	116,520
Feb.	93,533	54,466	80,601	47,606	12,932	6,860	113,616
Mar.	86,941	46,266	75,384	40,869	11,557	5,397	106,491
Apr.	83,320	47,064	72,763	41,449	10,557	5,615	99,573
4 mo.	357,356	202,414	308,154	175,671	49,202	26,743	.....

COPPER-BASE ALLOY

(Shipments of castings—1000 pounds[1])

	Shipments			Unfilled Orders[2]
	Total	Sand	Perm. Mold	
1954	835,930	753,179	48,848	.....
1955				
Apr.	84,183	75,903	5,152	51,111
4 mo.	323,818	291,360	20,077	.....
May	85,008	76,064	5,513	49,198
June	90,476	80,869	5,840	45,820
July	65,816	59,138	3,998	48,085
Aug.	87,206	77,721	5,322	51,251
Sept.	89,600	80,481	5,603	57,313
Oct.	91,192	82,958	4,513	56,751
Nov.	90,345	80,934	5,807	57,049
Dec.	88,287	78,327	6,368	57,146
Total	1,011,748	907,852	82,201	.....
1956				
Jan.	89,767	80,116	6,135	58,445
Feb.	91,706	82,244	5,888	57,515
Mar.	96,085	85,094	6,299	65,560
Apr.	90,679	81,333	5,835	68,106
4 mo.	368,237	328,787	24,157	.....

MAGNESIUM

(Shipments of castings—1000 pounds[1])

	Shipments		Unfilled Orders[2]
	Total	For Sale	
1954	25,777	22,950	.....
1955			
Apr.	2,633	2,405	6,800
4 mo.	9,670	8,792	.....
May	2,399	2,174	6,530
June	2,367	2,098	6,346
July	1,920	1,763	5,912
Aug.	2,176	2,002	5,964
Sept.	2,478	2,260	5,670
Oct.	2,302	2,077	5,394
Nov.	2,325	2,148	5,805
Dec.	2,255	2,018	5,981
Total	27,892	25,332	.....
1956			
Jan.	2,959	2,600	6,237
Feb.	2,977	2,720	6,704
Mar.	3,046	2,842	6,414
Apr.	3,140	2,949	7,137
4 mo.	12,122	11,111	.....

PRODUCTION WORKERS

Estimated Number

(Thousands)

	Mar. 1956	Feb. 1956	Mar. 1955
Ferrous	259,200	260,000	229,100
Nonferrous	87,100	89,000	84,200
Average Weekly Earnings			
Gray Iron	$3.23	$3.23	$1.54
Malleable Iron	$3.85	$4.26	$2.96
Steel	95.68	94.16	84.46
Nonferrous	$7.53	$7.10	$5.28
Average Weekly Hours			
Gray Iron	41.0	41.0	41.6
Malleable Iron	40.9	41.1	41.9
Steel	43.1	42.8	41.0
Nonferrous	40.9	40.7	41.0

Source: Bureau of Labor Statistics

GRAY IRON CASTINGS—SHIPMENTS (Net Tons[1])

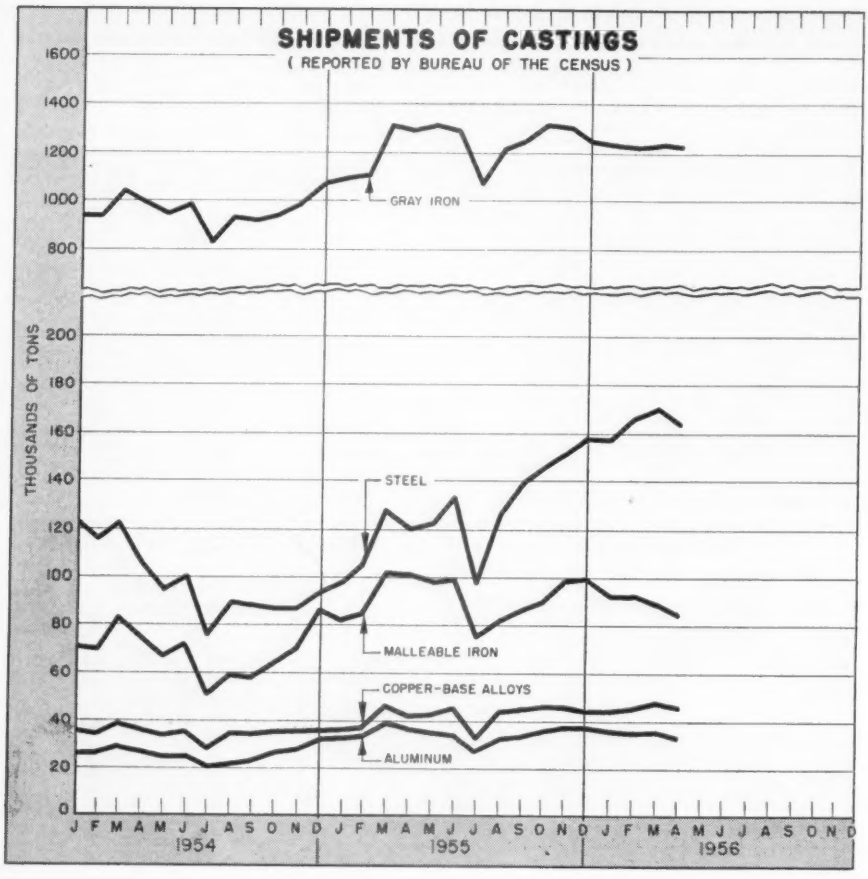
	All Castings		Miscellaneous Castings		Heavy Steel Ingot Molds		Chilled Railroad Car Wheels	Pressure Pipe & Fittings	Soil Pipe & Fittings	Unfilled Orders[2]
	Total	For Sale	Total	For Sale	Total	For Sale	Total	Total[3]	Total[3]	
1954	11,532,158	6,322,989	7,292,292	3,064,886	1,784,625	843,899	325,859	1,376,671	743,711	.....
1955										
Apr.	1,293,678	679,867	819,872	319,149	216,116	108,490	35,415	145,871	76,404	966,057
4 mo.	4,806,684	2,509,924	3,100,147	1,227,497	821,937	414,972	125,331	471,540	287,729	.....
May	1,310,424	707,105	803,897	315,072	227,236	117,915	35,966	168,772	74,553	937,949
June	1,296,196	715,862	793,067	327,520	228,044	117,727	43,807	147,351	83,927	981,918
July	1,069,711	579,122	634,869	246,297	210,130	112,137	28,181	129,191	67,340	1,049,565
Aug.	1,226,312	688,317	718,423	301,502	238,007	121,071	29,298	156,074	84,510	1,160,466
Sept.	1,252,736	712,688	731,073	314,223	244,199	124,811	29,953	165,332	82,179	1,150,933
Oct.	1,310,309	713,671	795,875	327,827	245,749	122,722	31,877	160,875	75,923	1,113,336
Nov.	1,305,633	696,523	797,854	327,580	262,506	127,739	29,795	148,560	66,918	1,061,546
Dec.	1,259,740	663,993	786,480	328,445	262,056	133,115	30,833	133,935	46,436	1,075,477
Total	14,837,745	7,987,205	9,161,685	3,715,963	2,739,864	1,392,209	385,041	1,681,630	869,558	.....
1956										
Jan.	1,249,518	677,017	769,826	326,269	257,150	132,581	32,408	131,346	58,788	1,157,818
Feb.	1,214,769	680,494	739,786	322,956	242,207	128,643	35,074	133,254	61,448	1,140,765
Mar.	1,255,405	715,173	752,498	331,749	254,045	139,624	42,676	132,384	73,802	1,162,578
Apr.	1,218,000	702,145	719,109	314,968	237,486	130,473	39,325	151,670	70,410	1,144,870
4 mo.	4,937,692	2,774,829	2,981,219	1,295,942	989,888	531,321	149,483	548,654	267,448	.....

STEEL CASTINGS—SHIPMENTS (Net Tons[1])

	All Castings			Carbon			Alloy			Unfilled Orders[2]
	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	
1954	1,184,096	880,158	135,581	802,321	580,474	120,309	381,285	303,428	15,315	.....
1955										
Apr.	120,053	92,237	16,646	84,247	63,214	15,163	35,806	28,993	1,483	221,336
4 mo.	452,281	346,936	66,295	315,130	236,087	61,193	140,525	110,849	5,102	.....
May	122,465	92,713	16,810	85,950	63,182	15,335	36,515	29,531	1,475	225,302
June	133,887	102,457	19,591	93,417	69,986	17,979	40,470	32,471	1,612	251,416
July	97,875	71,170	11,631	68,094	48,140	10,666	29,781	23,030	965	354,628
Aug.	126,406	96,290	20,576	91,245	68,514	19,094	35,161	27,776	1,482	413,531
Sept.	140,843	107,622	23,594	100,775	76,156	21,991	40,068	31,466	1,603	420,616
Oct.	145,674	110,409	23,745	105,345	79,235	22,375	40,329	31,831	1,370	418,063
Nov.	152,381	116,908	25,635	111,571	84,064	24,050	40,810	33,518	1,585	453,113
Dec.	158,982	122,201	29,003	116,872	88,894	26,919	42,110	33,307	2,084	475,335
Total	1,530,694	1,166,706	236,880	1,088,489	814,258	219,602	445,769	354,452	17,278	.....
1956										
Jan.	158,618	123,343	27,954	116,092	88,480	26,362	42,526	34,863	1,592	519,401
Feb.	165,398	128,598	30,833	123,279	94,998	29,112	42,119	33,600	1,721	567,330
Mar.	170,045	130,839	31,991	126,583	95,779	29,953	43,462	35,060	2,038	594,990
Apr.	163,708	125,015	27,475	121,723	91,332	25,302	41,985	33,683	2,173	600,242
4 mo	657,769	507,795	118,253	487,677	370,589	110,729	170,092	137,206	7,524	.....

[1]Source: Bureau of Census. [2]For sale only. [3]All cast iron pipe is shipped for sale.

←Circle 694 on Inquiry Card—Page 201


SHIPMENTS OF CASTINGS
(REPORTED BY BUREAU OF THE CENSUS)
THOUSANDS OF TONS
GRAY IRON
STEEL
MALLEABLE IRON
COPPER-BASE ALLOYS
ALUMINUM
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1954
1955
1956

COKE PRODUCTION AND CONSUMPTION

(Net tons*)

	Production	Consumption Total	Consumption By Foundries
1954	59,526,723	59,139,159	2,479,926
1955			
Apr.	6,135,645	6,164,459	278,242
4 mo.	23,571,646	23,852,536	1,041,380
May	6,426,747	6,570,567	277,967
June	6,148,026	6,297,338	249,525
July	6,169,770	6,266,631	221,372
Aug.	6,395,422	6,439,101	249,425
Sept.	6,397,133	6,501,013	260,608
Oct.	6,630,609	6,813,118	283,818
Nov.	6,545,862	6,577,008	285,021
Dec.	6,865,032	6,949,073	284,936
Total	75,150,247	76,266,385	3,154,052
1956			
Jan.	6,914,836	6,182,704	275,660
Feb.	6,476,135	6,506,044	260,949
Mar.	6,896,593	6,861,698	267,414
Apr.	6,633,363	6,572,836	247,664
4 mo.	26,920,927	26,123,282	1,051,687

INGOT BRASS AND BRONZE

(Shipments in net tons)

	1955	1956
Jan.	25,201	27,736
Feb.	25,349	24,949
Mar.	29,713	28,310
Apr.	27,641	25,808
May	23,708	23,437
June	23,141	.....
July	18,513	.....
Aug.	27,013	.....
Sept.	26,349	.....
Oct.	25,228	.....
Nov.	25,102	.....
Dec.	21,448	.....
Total for year	298,406	106,803

Source: Defense Council of the Ingot Brass and Bronze Industry

ZINC-BASE ALLOY

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1954	520,501	322,845	.....
1955			
Apr.	71,595	45,477	81,756
4 mo.	260,577	160,890	.....
May	63,735	38,124	74,472
June	66,569	42,753	71,344
July	47,928	27,429	68,927
Aug.	62,677	61,957	75,592
Sept.	62,030	43,498	80,660
Oct.	71,689	46,581	85,489
Nov.	75,099	47,572	93,001
Dec.	70,950	47,547	86,120
Total	781,254	516,351	.....
1956			
Jan.	68,050	43,750	83,234
Feb.	66,854	42,300	76,283
Mar.	65,760	42,806	73,025
Apr.	58,274	37,518	71,730
4 mo.	258,938	166,374	.....

INDEX OF FOUNDRY EQUIPMENT ORDERS

Foundry Trades Only
(Net Orders Closed, New Equipment)

	1955	1956
Jan.	81.0	195.6
Feb.	90.4	169.0
Mar.	163.6	152.7
Apr.	178.6	135.2
May	145.7	....
June	186.8	....
July	213.4	....
Aug.	134.0	....
Sept.	156.7	....
Oct.	108.6	....
Nov.	154.4	....
Dec.	183.9	....

Note: Figures are percentages of the base period 1947-49 taken as 100 per cent monthly average). This is a new base period. Source: Foundry Equipment Manufacturers Association.

IRON AND STEEL SCRAP CONSUMPTION

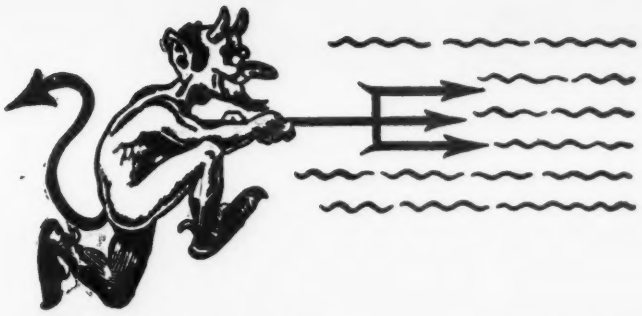
(Gross tons*)

	All Scrap Total	By Types of Furnace—Cupola Total	By Types of Furnace—Air Total	By Types of Furnace—Electric Total
1954	54,780,758	8,542,581	855,207	6,100,444
1955				
Mar.	6,313,717	993,266	113,198	727,401
3 mo.	17,080,221	2,630,413	295,736	1,919,521
Apr.	6,239,036	975,751	108,965	726,138
May	6,415,947	963,082	109,074	745,060
June	6,117,573	928,908	116,419	733,573
July	5,447,130	730,735	81,216	623,623
Aug.	5,913,031	868,644	101,607	765,343
Sept.	6,060,491	881,158	119,550	753,318
Oct.	6,443,349	944,685	113,411	820,642
Nov.	6,441,351	952,906	112,056	839,971
Dec.	6,496,796	910,675	115,436	830,404
Total	72,654,925	10,786,957	1,273,470	8,757,593
1956				
Jan.	6,688,977	909,201	114,378	880,980
Feb.	6,345,421	892,373	116,418	833,661
Mar.	6,733,076	923,912	101,087	863,950
3 mo.	19,767,474	2,725,486	331,883	2,578,591

PIG IRON PRODUCTION AND CONSUMPTION

	Production** (Standard grades—net tons) Total	Foundry	Malleable	Basic	Low Phos. Intermediate Low Phos. & Bessemer	Consumption* (By type of furnace—gross tons) Total	Cupola	Air	Electric
1954	58,113,924	2,241,436	2,798,646	47,485,047	5,587,465	52,373,541	4,364,418	215,158	155,258
1955									
May	6,753,236	246,661	342,544	5,385,299	788,732	6,044,882	471,657	21,448	20,085
5 mo.	30,614,054	1,131,643	1,532,456	24,821,876	3,138,079	26,768,642	2,238,427	106,500	91,490
June	6,494,838	238,412	347,631	5,245,861	662,934	5,774,896	454,751	22,871	21,697
July	6,329,393	233,235	344,365	5,116,960	634,833	5,430,550	361,171	16,483	19,535
Aug.	6,529,580	251,459	319,951	5,214,901	743,269	5,769,689	442,532	22,014	25,685
Sept.	6,653,578	252,630	343,919	5,397,134	659,895	5,903,190	445,099	23,340	24,552
Oct.	6,905,280	267,405	315,045	5,647,527	675,303	6,193,512	470,610	22,659	23,328
Nov.	6,636,649	241,727	353,713	5,404,584	636,625	5,973,223	469,485	22,621	18,148
Dec.	6,887,667	242,446	329,607	5,660,307	655,307	6,131,680	444,459	23,520	21,971
Total	77,114,073	2,858,957	3,884,971	62,570,394	7,799,751	68,944,698	5,326,534	260,008	246,406
1956									
Jan.	6,985,945	210,755	317,216	5,806,140	651,774	6,275,224	441,634	24,062	11,766
Feb.	6,539,199	229,440	370,208	5,350,650	588,901	5,871,824	430,792	24,307	13,010
Mar.	7,083,877	196,533	352,856	5,843,852	690,636	6,316,836	427,177	23,737	18,725
Apr.	6,860,833	210,319	333,660	5,623,647	693,207	.....	.....	.....	.....
May	6,873,102	232,375	329,750	5,625,067	685,910	.....	.....	.....	.....
5 mo.	34,342,956	1,079,422	1,703,750	28,249,356	3,310,428	.....	.....	.....	.....

*Source: U. S. Dept. of Interior. Bureau of Mines. **Source: American Iron & Steel Institute. [1]Source: Bureau of the Census. [2]For sale only.



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for *all* Metals and Alloys

THERMOTOMIC "X" COMPOUND is an exothermic material which is molded and baked into necked down riser cores and inserts. It produces a temperature of 3500° F. and is used as ring inserts under the risers or feeding heads. Great savings are realized through reduced riser dimensions and cleaning costs. In conjunction with Thermotomic Compounds, Carbon Free Liquidizer No. 5 should be used on top of the metal in the heads.

THERMOTOMIC ABC—For aluminum and magnesium castings, necked down riser cores and inserts — prevents piping and shrinkage into castings. Soffel's ALX-31 Liquidizer should be used on top of the metals in the head.

THERMOTOMIC "HoTop" LIQUIDIZER — for short risers—saves 60 to 70% of feeding metal in the heads.

EXOTHERMIC CARBON FREE LIQUIDIZER—A feeding head compound for castings and ingots of ferrous and non-ferrous metals—saves metal and prevents piping and shrinkage.

CARBON FREE LIQUIDIZER AL-X31—For aluminum and magnesium feeding heads—prevents piping.

EXOTHERMIC INSULATING SLEEVE CORE COMPOUND—For riser sleeves—adds heat and prolongs fluidity of feeding metal in heads or risers.

DENSILTITE LADLE FLUX—For iron and semi-steel — reduces sulfur and phosphorus. Adds fluidity and temperature in pouring ladles—produces clean iron.

SOFFEL'S NON-FERROUS FLUXES

BB-2—For red brass, nickel and tin bronze pressure castings—removes sulfur, iron, phosphorous oxides and gas from brass and bronze.

SUPER BRASS FLUX—For brass and bronze—prevents oxidation of zinc.

BRASS REFINING FLUX—For cupola melting and open flame furnaces — prevents oxidation. Produces liquid slag and faster melting.

COVERALL BRASS FLUX—Removes gas and oxides from yellow brass and nickel silver.

RADIOCLARITE BRASS FLUX—For open flame furnace melting—increases fluidity, tensile strength, removes gas, oxides and iron.

AB-6 BRASS FLUX — for electric furnace melting of brass and aluminum bronze— keeps furnace linings clean.

KLEEN-ALL BRASS CLEANER—For use in bottom of pouring ladles or open flame furnaces to absorb liquid slag and keep the furnace and ladle linings clean.

BRASS ALUMINUM REMOVER — Removes all traces of aluminum from copper, brass or bronze.

HI-LED BRONZE FLUX—Holds lead up to 50% in copper without use of nickel.

NICKEL MONEL FLUX — Removes gas and adds fluidity to metal.

ALUMINUM BRONZE FLUX—A perfect deoxidizer for reducing aluminum and iron oxide in manganese bronze and aluminum bronze. Adds fluidity.

COPPERTITE FLUX—For high conductivity castings—removes cuprous and cupric oxides and gas from copper.

FERRO-OUT IRON REMOVER—Removes free iron or alloyed iron from brass, bronze or copper.

SOFFELITE ALUMINUM FLUX—Removes aluminum oxide and iron from aluminum and increases the fluidity and tensile strength.

MAGNALUM FLUX—For magnesium and aluminum alloys—removes gas and oxide and increases fluidity.

KLEN ZINC FLUX—A deoxidizer and purifier for zinc base pressure die castings—removes gas, sulfur and iron.

DIE COATING—For pressure zinc base die castings —will not scale, blister or create gas in the molds.

PERMANENT MOLD COATING—For aluminum and magnesium castings — adds longer life to molds. Produces clean gas free castings.

POT COATING—For iron pot melting — increases life of pots. Prevents iron pick up.

U. S. Patents No. 2,490,327 and No. 2,500,097

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World's Largest Manufacturer of Fluxes and Purifiers For All Metals and Alloys

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Foundry Group Meetings

Pittsburgh: Hans J. Heine, technical director, AFS, discussed "AFS Research — Your Foundry's Silent Partner" at the May 21 meeting of the AFS chapter at Webster Hall Hotel, Pittsburgh.

The group elected new officers for the 1956-1957 year. New president is Earl J. Biller, general superintendent, Vulcan Mold & Iron Co., Latrobe, Pa. George Miklos, Westinghouse Electric Corp., is to be vice president, while E. P. Buchanan of Pittsburgh Coke & Chemical Co. continues as secretary-treasurer.

Mr. Heine discussed research conducted by AFS, its broad aims and future possibilities in the foundry industry through improved research. He showed slides demonstrating sand research. "At AFS we try to make experimental work practical in its application," he pointed out.

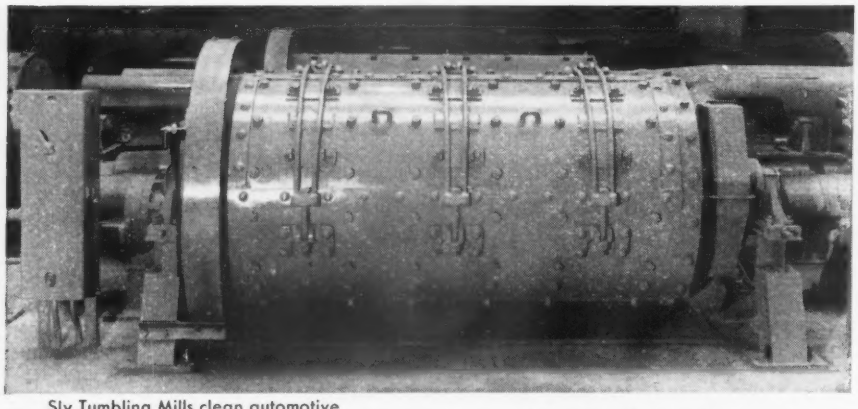
Mr. Heine showed a 40-minute sound motion picture on gating research work at Battelle Memorial Institute, with particular emphasis on principles of vertical gating.—*Robert M. Love.*

Reading: Paul K. Reiniger, Textile Machine Works, Wyomissing, Pa., was re-elected president of the Reading Foundrymen's Association at its May 15 meeting at the Berkshire Hotel, Reading, Pa. Other officers elected were John W. Swengel, American Chain & Cable Co., vice president; Paul C. Holland, Beryllium Corp., treasurer, and William I. Cassidy, secretary.

Howard E. Edsall, Birdsboro Armorcast Inc., Birdsboro, Pa., Paul B. Harner, Union Mfg. Co., Uniontown, Pa., Daniel Heckman, Empire Steel Castings Inc., George C. Kissell, Fairmount Foundry Inc., Hamburg, Pa., Robert M. Schumo, Pennsylvania Electric Steel Casting Co., Hamburg, James H. Stewart, Reading Gray Iron Castings Inc., and James Woodward, Excelsior Brass Works Inc., were elected to the executive committee.

A roundtable discussion of the CO_2 process was moderated by Hans Jacob, foundry superintendent, Lehigh Inc., Easton, Pa. Other panel members were Mr. Woodward, John M. Franks, plant manager, East Penn Foundry Co., Macungie, Pa., and Harold K. Kurtz, metallurgist, Empire Steel Castings Inc. An AFS film on the CO_2 process also was presented.—*William I. Cassidy.*

Northeastern Ohio: Over 300 members of the AFS chapter attended the annual picnic and golf outing at Twin Lakes Country Club, near Kent, O., on June 30. Golf, horseshoes and softball preceded the customary steak dinner and drawing for valuable door prizes. The vendors turned the tables on the foundrymen in the grudge softball game and were presented with the small "charged" cupola as their reward.—*Kenneth L. Mountain.*



Sly Tumbling Mills clean automotive castings fast and at lower cost.

castings cleaned RED HOT

cleaning costs slashed!

With Sly Tumbling Mills, operators are cleaning castings right out of the shakeout, without worry about temperature — and, at the same time, reducing costs up to 75%. *No other cleaning method can do this.*

Today, due to the increasing use of shell molded castings and other methods, castings are much cleaner than formerly. Foundry executives are way ahead cost-wise by using Sly Tumbling Mills instead of expensive blast cleaning equipment. They find big savings, too, in the complete cleaning that results.

Sly Tumbling Mills Bring All These Savings

- Clean thoroughly . . . save hours and hours of grinding time by *eliminating fins as they clean.*
- Clean all castings at once — no individual handling of pieces.
- Do a perfect job on shell molded castings where surfaces need improving.
- Permit use of unskilled labor during an evening shift or after shakeout, using the shakeout gang to load and unload mills.

These savings are important! May we send complete information?

Manufacturers and Designers of: Dust Control Systems, Blast Cleaning Equipment, Tumbling Mills, Industrial Ovens.

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OFFICES IN PRINCIPAL CITIES

Circle 696 on Inquiry Card—Page 201

The number of full-time foundry teachers in FEF accredited engineering colleges has increased 400% in the last nine years.

The accompanying chart proves that foundrymen's interest in this subject is moving mountains . . . in the direction of a better industry.

It's up to you, literally, to keep up the momentum.

INSTRUCTION STAFFS—FOUNDRY PROFESSORS

Write for booklet "Let's Look Ahead".

You'll be glad you did.

Foundry Educational Foundation

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consistently-from one lot to the next-has everything you expect and pay for in premium shot

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Pittsburgh 1, Pa.

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Circle 698 on Inquiry Card—Page 201

Meditations of a Sandman

By HAROLD E. HENDERSON
H. C. Macaulay Foundry Co.
Berkeley, Calif.

"Communication"

IN A country where all of us presumably speak some variation of English, it would seem that there should be no difficulty about clearly understanding each other, but we know that this is not true. In our own, every-day experience, we encounter numerous examples of the breakdown in communication, of orders improperly given, misinterpreted or misunderstood completely. This problem of meaning applies to foundry activities as much as to any other.

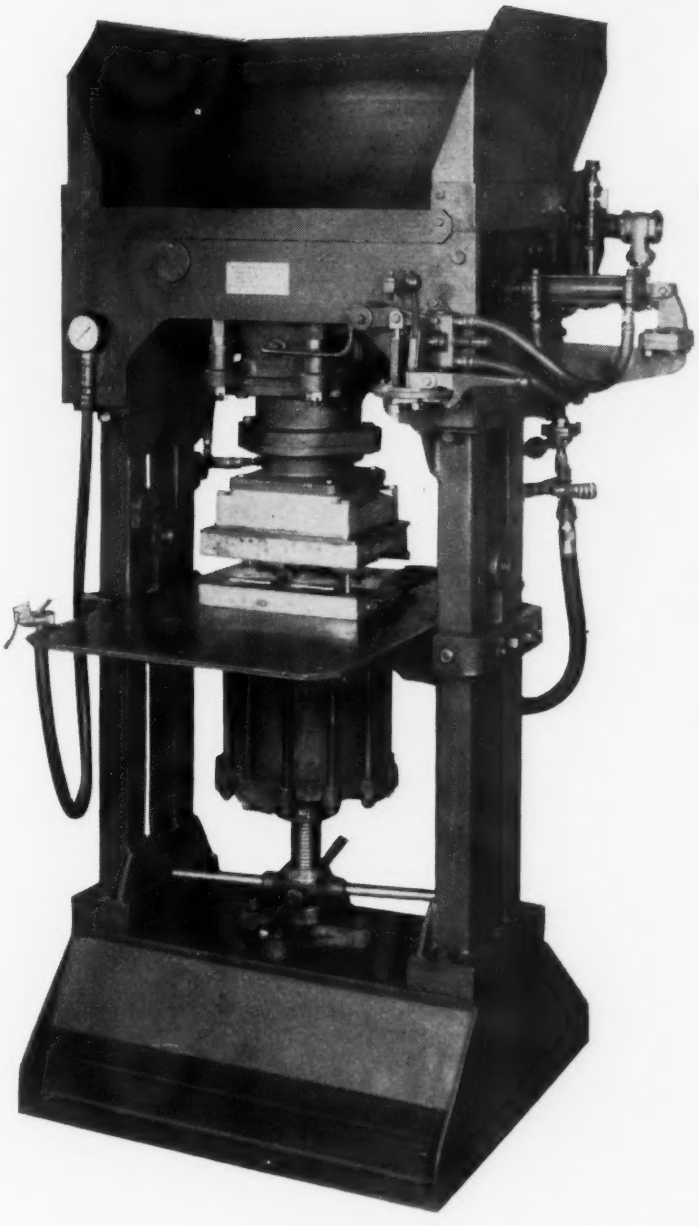
For example, men entrusted with the mixing of foundry sand, especially muller men, should be schooled carefully in the meaning of measurement. Many of these men never have been instructed in the significance of ratio or proportion, and most of them have a very hazy idea of percentage. For instance, if the average foundryman were to write out all of his sand mixes, defining the amount of each ingredient to be added in percentage by weight, how many muller men today could fill the prescription even approximately?

Our sand usually is measured by the cubic foot, which is loosely considered to be 100 lb. It actually varies between 75 and 96 lb dry. If it is wet, the picture changes considerably. Assuming that the cubic foot box is filled in the same manner each time, a relationship in weight can be established without harmful deviation. However, few sands are equal in their volume-weight relation, either wet or dry.

Both grain size and clay content are determining factors. I have a sand which is exceptionally light and carries about 14 per cent clay and other fine material. This sand, dry, weighs 75 lb per cubic foot: Yet wet (10 per cent moisture), as we usually get it, the weight is only 70 lb. This figure brings our cubic foot of sand as received by the muller, minus water, to 63 lb, far short of the loosely accepted 100-lb standard.

We speak of the capacity of a certain muller as being 10 cu ft or 1000

Redford No. 4-D DRAW TYPE CORE BLOWER



Designed primarily to fill the need for a fast and flexible draw type machine to handle work from a few ounces to 10 lbs., the Redford #4-D can be quickly adjusted to accommodate core boxes not requiring the draw feature, or can be equipped with a clamp to handle vertically parted core boxes.

Rugged construction, simplicity of change-overs and a fast operating cycle make it suitable for either jobbing or high production work.

Exhaust air is utilized to thoroughly fluff the sand remaining in the sand magazine after each blow, thus reducing the possibility of cratering.

The stationary sand magazine and accurately guided draw table assure perfect drawing of the cores. Vibration of the core box is automatic.

Magazine heads normally furnished with the #2 Redford machine can be used with the #4-D Redford. Larger new type magazine heads especially suited for draw type work are also available as standard equipment.

Valves are designed to assure maximum safety. The operator must use both hands at the same time in order to clamp the core box.

The Redford #4-D has been thoroughly proven in both small and large foundries. To get complete information write for Bulletin 4-D.

Redford IRON & EQUIPMENT CO.

20733 GLENDALE AVENUE • Phone KEnwood 1-8611 • DETROIT 23, MICHIGAN

Circle 699 on Inquiry Card—Page 201

lb, yet 10 cu ft of my sand would weigh but 630 lb. Shall I increase this volume to 16 cu ft, bringing the weight to 1008 lb, or reduce my additives to meet my actual 630 lb of sand? That might at first sound like a silly question, but if you will check carefully your own sand practice, it may provide some startling information.

Weights of Additives—Let us consider next our additives: Bentonite, corn flour, wood flour, pitch, seacoal, core oils, resins, etc., to determine the volume-weight relation. We've been told, "A pint's a pound the world around," and perhaps that's close enough when we are measuring water or core-oil, although you can get a good argument on this point, too.

But most of us who still rely on volumetric measure have not checked closely the weights of our various materials or of the containers with which we do the measuring. We actually have a very poor conception of the percentages we profess to be using. I freely confess to being as guilty in this respect as any reader who may feel that he is being lectured.

Most of us have become a little tired of being told repeatedly that we have measures that do not measure, and perhaps it's because we are a little tired that we don't do something about it. The fact remains that until we either weigh all ingredients or use volume measures of known capacity, and check their accuracy at frequent intervals, we cannot be sure of our percentage standards or prevent costly deviations.

I find that in the mixing of both green and dry molding sand, the man at the muller is doing a fairly good job. His margin for error in the measurement of additives is sufficiently flexible to enable him to keep out of serious trouble. In jobbing work, a little more or less of bentonite, wood flour or seacoal will have no damaging effect upon a ton of sand. If his gallon can is a pint short, the ultimate difference in strength is usually imperceptible, and the behavior of the sand varies little.

Moisture Control — His moisture control however, is another matter. Here, his extra gallon of water becomes an increase of nearly ½ per cent and can be responsible for a great deal of damage. I would be willing to forgive most of the errors at the muller if I could guarantee the moisture content of sand as it enters the molding flask.

Now we come to the preparation of core sand. Here, no leniency is permitted. All measures *must be* more nearly exact. Although we know that *all* materials should be added by weight, few of us use this system, even though most of us ultimately will arrive at it. Volume measure still seems customary, and such measures too frequently are inaccurate. This situation generally results in a waste of expensive core oil and in undried cores that creates an even more expensive form of waste.

Here again, moisture control is of dominant importance, especially in the operation of a coreblower. Not only will water (in excess or deficiency) alter the properties of a core mix, but it can radically affect the workability of the sand. In addition to this, it can prove directly responsible for over or underbaking.

Somewhere in our technical papers it has been stated that an increase of 1 per cent moisture in a normal core mix will require 25 per cent additional baking time. While this statement may not be literally true in every instance, it is indicative of the importance of the problem.

LIBERTY BELL REPLICA: To celebrate Military Reserve Week, April 22 to 28, this precise replica of the Liberty Bell was cast for the Copper & Brass Research Association by General Bronze Corp., Garden City, N. Y., on behalf of the entire copper industry as a tribute to the Industrial College of the Armed Forces. Cast by the lost-wax process of an alloy of 79 per cent copper and 21 per cent block tin, it is 20 in. high and weighs 45 lb. Left to right are C. T. M. Jaeger, Kennecott Copper Corp.; Joseph F. Hobbins, Anaconda Co.; and Carl H. Pihl, Copper & Brass Research Association, representatives of the copper industry

Foundry Accident Rate Rises, Severity Off, Says Council

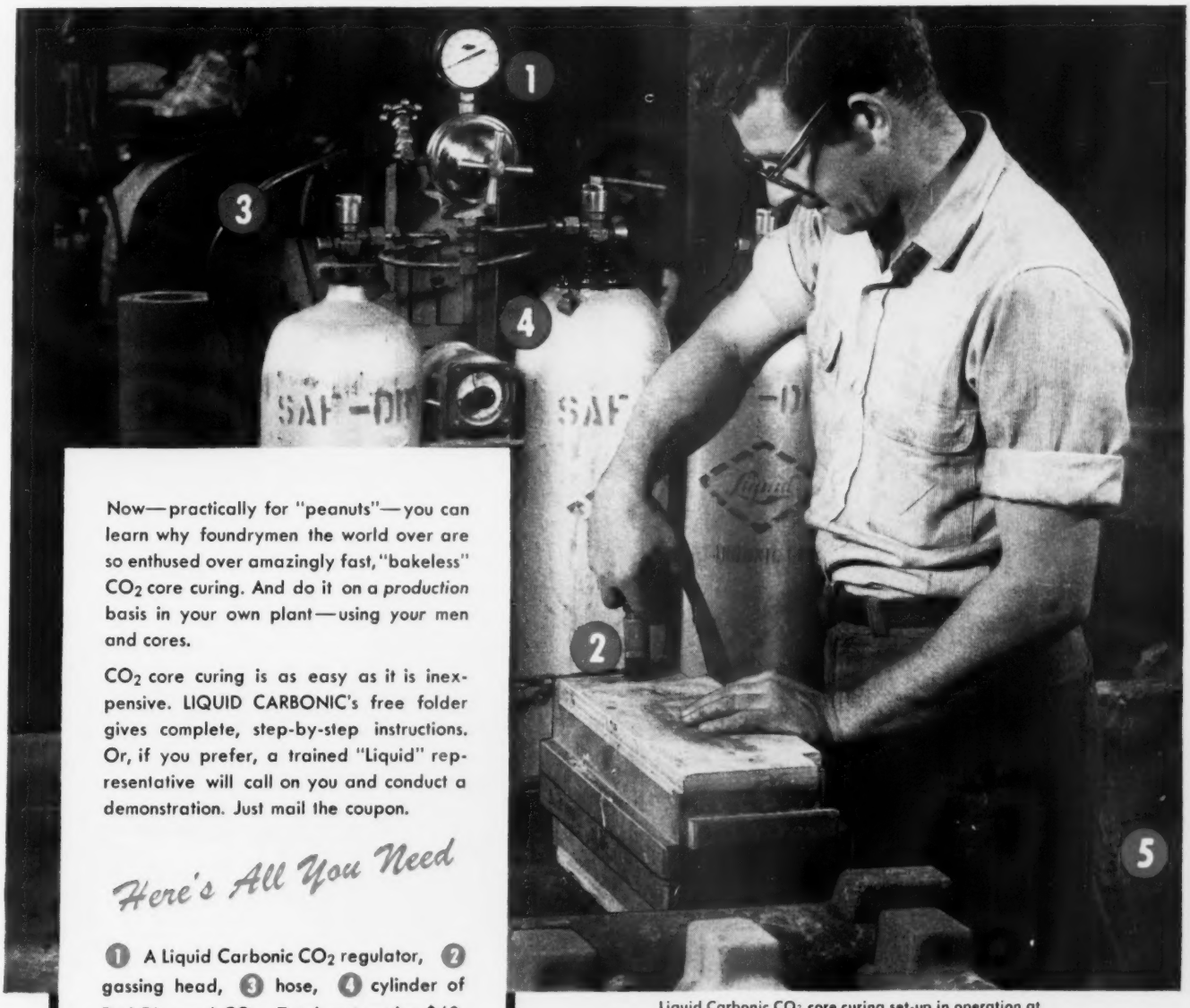
Foundry members of the National Safety Council reported an increase in their rate of accidents during 1955 but a decrease in the severity of such mishaps. Industry as a whole showed a decrease in frequency but greater severity last year.

Among 40 industry classifications, foundries ranked 27th in accident rate with 9.45 disabling injuries per million man-hours. This was an increase of 7 per cent over the 1954 frequency. The average for all industry was down 4 per cent at 6.96. The steel industry had a frequency of 4.16.

Foundries also stood 27th in point of severity of accidents. They lost 814 days per million man-hours worked as the result of accidents. This was practically the same as the average of 815 days for all industries and 6 per cent less than in 1954.

Safety records of foundry members of the National Safety Council are two to three times better than that of the foundry industry as a whole.

a production CO_2 core curing set-up for less than $50.00



Liquid Carbonic CO_2 core curing set-up in operation at Pacific Brass Foundry, San Francisco, California.

Now—practically for "peanuts"—you can learn why foundrymen the world over are so enthused over amazingly fast, "bakeless" CO_2 core curing. And do it on a *production* basis in your own plant—using *your* men and cores.

CO_2 core curing is as easy as it is inexpensive. LIQUID CARBONIC's free folder gives complete, step-by-step instructions. Or, if you prefer, a trained "Liquid" representative will call on you and conduct a demonstration. Just mail the coupon.

Here's All You Need

1 A Liquid Carbonic CO_2 regulator, 2 gassing head, 3 hose, 4 cylinder of Red Diamond CO_2. Total cost, under $40. 5 *Special Binder.* Available from numerous sources at little more than core oil cost. Binder coats sand particles, reacts with CO_2 to harden cores in seconds.

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What a Research Lab Can Do for a Small Business

A Small Business Can Make Research Pay for Itself

By James O. Bengston*

HOW much does it cost to set up and staff a small laboratory?

At first glance, the question may seem no more sensible than asking how long is a piece of string. But it's a vital question, one that must be answered, for small companies in the foundry industry.

In the last 25 years, the average dollar invested in science returned a dividend of $60. The return will be as great or greater in the next 25 years, we are assured, and the small company must get its share of the dividend. It's time to shatter the notion that research is feasible for the DuPonts and the General Electrics, but not for the small company.

The direct answer to the question of how much it costs to set up a laboratory is that it *can* be done for as little as $5000. Many small companies are benefiting right now from such an initial research investment. The next question concerns the cost of staffing a small laboratory. Some companies have one man in charge of both research and quality control.

Although the range from such a laboratory to General Motors' new $100,000,000 technical center is wide, both have their place in industry. The small company simply must pinpoint its targets carefully and proceed along a narrow research path.

For example, the National Science Foundation lists seven areas in which research benefits our economy. Three of them would be a substantial risk for the small company which expects tangible results in minimum time:

1. Development of entirely new products, such as air conditioners, synthetic drugs and insecticides.

2. Development of products that displace old ones, such as diesel locomotives, frozen foods and automatic washing machines.

3. Using and upgrading byproducts such as petrochemicals and coal tars.

Four areas, however, offer fairly definite prospects for the small company:

1. Lowering the cost of production. A specific example comes to mind immediately. A Chicago paint manufacturer with 35 employees and annual sales of about $1,000,000 employs two chemists with the dual responsibility of controlling quality and lowering production costs.

Their laboratory equipment would

*President, Chicago Apparatus Co., Chicago.

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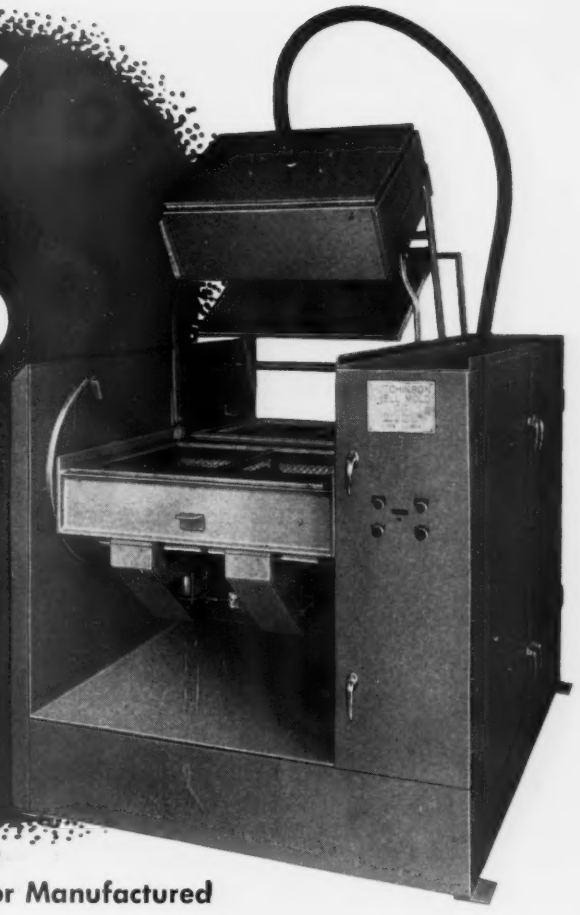
consistently produces molds in 37 to 60 seconds



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Natural or Manufactured

Due to a unique method of hinging the investment box to the pattern carrying frame, no other shell mold machine can match the HUTCHINSON in shell mold production. For practically all patterns the total required cycle will not exceed 60 seconds . . . simpler patterns require as little as 37 seconds! Can be set for manual or automatic cycle. Available in twin sets.

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Frame is constructed entirely of all welded steel channels and ⅜" steel plate. Magnetic braking gives smooth stopping action to all major components. Stands up under hard, repeated usage as proven by years of service in our own foundry and in the field. Gives the ideal twin economies—increased production and reduction of maintenance costs.

Accurate

Characteristics of the machine prevent ram-off or shadow. Each phase of the operating cycle can be adjusted and timed precisely to any operating requirement. Castings produced by the Hutchinson Shell Mold Machine consistently have . . .

- Exceptionally Fine Finish
- Closer Dimensional Tolerances
- Fewer Casting Defects
- More Uniformity

Model No.	Max. Shell Size	Heat	Length	Width	Height	Wt.
2030	20 x 30	Gas	65 in.	58 in.	100 in.	3200
1424	14 x 24	Gas or Electric	46 in.	46 in.	90 in.	1900
1418	14 x 18	Gas or Electric	46 in.	36 in.	90 in.	1700

Electric—220/440, 60 cycle, 3 phase **Air Pressure—100 psi**

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cost about $10,000 at today's prices. They recently saved their company almost that amount on one project. An important customer was using a paint with a bright red pigment which cost 90 cents a pound. The two laboratory men proved to the customer that he could get equally good results with a new product they developed from two pigments costing 70 cents a pound.

Obviously, the chances are about 1000 to 1 that this small laboratory will develop anything as important as rubber-base paint or a DuPont auto finish. But the two chemists *are* providing the manufacturer with technical skills that help him stay ahead of competition. "Our company can't afford to be without a laboratory," is one of this manufacturer's favorite remarks.

2. Decreasing maintenance costs of old products certainly is another area of investigation for the small company. Many, many product improvements in this area have come from the small laboratory.

3. Increasing the useful life of existing products. An outstanding small company that comes to mind is Culligan Inc., manufacturer of water conditioning equipment, which solved its own problem of product life.

In 15 years of research, Culligan studied more than 500 variations of four totally different methods for curbing corrosion, long the major problem in water conditioners. A year ago, Culligan's laboratory men worked out a method of bonding plastic to metal, resulting in a water softener with more than double the life of equipment then on the market. Company engineers also designed a virtually automatic assembly line to produce the new tanks at a very small increase in cost.

4. Expanding markets for old products by improving their utility, quality, or appearance certainly is another area for the small company. Zonolite Co., which mines vermiculite, a lightweight insulation material, owes much of its success to continued research into new uses. The company not only develops many noninsulation uses, but actively encourages other industrial laboratories to experiment with vermiculite.

It's easy to cite chapter and verse on successful small laboratories, but it isn't necessary to do so. Most businessmen agree on the value of research in the abstract. It's simply that they have honest doubts that a laboratory in their own plant will be anything more than a pig in a poke.

"Where can I get advice on the subject?"

"How will I know I'm getting my money's worth?"

"What are other companies my size doing?"

Those are the questions that plague the hesitant businessman.

First, they might talk things over with their suppliers and customers. Undoubtedly, many will be glad to share their experiences in research. They will have valuable advice on practical methods and practical projects.

They also might enlist a management consultant firm to help spot the areas where laboratory work would help them.

Secondly, they might seek very specific help from a laboratory equipment company. There they can find technical personnel to help them pinpoint objectives and methods, to recommend equipment and supplies that will be most useful to them and even to help recruit personnel.

This laboratory equipment supplier, who deals with hundreds or thousands of other companies, should be an invaluable source of information. He knows what others are doing and how much it costs them to do it. He is able to help any firm to keep its initial investment to a minimum.

For example, it is now possible to finance the purchase of laboratory equipment over several years. If a company cannot afford a large capital outlay, the laboratory supply company can help to arrange such financing.

Finally, small businessmen can turn to universities, technical societies and trade associations for counsel. Their contributions might be of a general nature, but they should help businessmen to know what to expect and what not to expect.

Many new and dazzling scientific instruments are available. Automation can be effected in the laboratory as well as on the production line. But it would be idle to talk about new research techniques and to cite fabulous research payoffs in the foundry industry until the very basic questions are answered.

If a small business decides to have a laboratory, it first of all must decide on objectives, costs, controls and procedures.

Gray Iron Management Groups Hold Second Joint Meeting

Thirty-six representatives of the Chicago Area and Milwaukee Management Groups of the Gray Iron Founders' Society attended a joint meeting at Hank's Restaurant, Waukegan, Ill., June 19. It was the second consecutive year the two have held such a gathering.

Chester R. Lindgren, president, Lindgren Foundry Co., Batavia, Ill., and chairman of the Chicago Area Group, presided. The program was headlined by three members of the Cleveland staff of the Gray Iron Founders' Society, including E. Harold Mitchell, field director; Richard C. Meloy, marketing director, and

TOTAL SERVICE 229 YEARS: West Steel Casting Co., Cleveland, celebrates its 50th anniversary in 1956 and salutes these seven employees, who have served a total of 229 years with the company. Left to right are Harry J. Redrup, pattern storage, 34 years; Angelo Sirna, air compressor attendant, 31 years; Herbert Wolkersdorf, truck driver, 40 years; George Ivey, core sand mixer, 32 years; John Tremba, crane operator, 30 years; John Wain, coremaker, 29 years; and William Belcher, core paster, 33 years

Quality starts in the furnace!

Jenkins Bros. uses nine Detroit ROCKING Electric Furnaces to melt bronze for valves

Top grade valves require top quality castings. And top quality castings require metal that is *right.*

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PRECISE CONTROL OF ANALYSIS—Melt-analysis can be controlled very exactly in these great furnaces, with metal of the desired characteristics produced in heat after heat. Accurate temperature control allows establishment of the most advantageous pattern for operation, and duplication of that pattern for each melting cycle. The rocking action of the furnaces assures homogeneous melts and a more complete utilization of generated heat because of the flow of molten metal back and forth on the lining.

NOTE THESE ADVANTAGES—Other important advantages of Detroit Rocking Electric Furnaces are economy of power consumption, minimum heat loss, less metal shrinkage, fewer scrap castings, more heats per shift or working day, reduced out-of-production time because of long refractory wear and simple shell replacement, trouble-free operation.

Detroit Electric Furnaces range from 10 lbs. to 4000 lbs. capacity, individually designed to fit your plant's electrical specifications. They melt ferrous and non-ferrous metals with equal efficiency.

GET FULL INFORMATION—For full information on the advantages of Detroit Electric Furnaces for your foundry, send us your operating data. We'll give you full details. Write today.

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Foreign Representatives: in BRAZIL—Equipamentos Industrias, "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N.Y.; MEXICO: Cia Proveedora de Industrias, Atenas 32-13, Apartado 27A3, Mexico 6, D.F., Mexico; EUROPE, ENGLAND: Birlec, Ltd., Birmingham.

Charles F. Walton, technical director.

Mr. Mitchell reported on the scrap situation which has been irritating to foundrymen because of the inadequate export restrictions in force. He indicated there is some assurance now that remedial steps will be taken by the government to safeguard domestic supplies. He also reviewed the society's field activities and plans for future meetings.

Having just become a member of the headquarters office staff a few days previously, Mr. Meloy could speak only in general terms of the marketing activities now being formulated. However, he was enthusiastic over the guidance these steps will provide to association members.

"What Your Customer Really Wants" was the subject Mr. Walton discussed at some length. He named price, delivery, quality and service, as the four considerations in a sale. It is the customer, not the foundry, who puts price first in the list. The foundryman, he contended, can put price in the place it belongs in the list.

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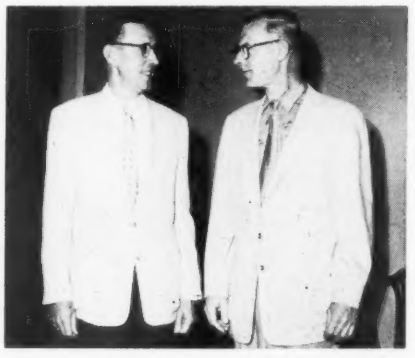
Alloy Casting Institute Picks Officers at Annual Meeting

Bradley B. Evans, sales manager, Empire Steel Castings Inc., Reading, Pa., was elected president of the Alloy Casting Institute at the institute's 16th annual meeting at Hot Springs, Va., June 24-26. He succeeds Thomas Rutherford, the Midvale Co., Philadelphia.

F. M. Fahrenwald, president, the Fahralloy Co., Harvey, Ill., was elected vice president of the institute, succeeding Mr. Evans, who served in this capacity last year. E. A. Schoefer, Mineola, N. Y., was re-elected executive vice president and treasurer.

A native of Erie, Pa., Mr. Evans was graduated from Westminster



Bradley B. Evans, left, and Francis M. Farhenwald, new president and vice president, respectively, of the Alloy Casting Institute at annual meeting

College, New Wilmington, Pa., and later attended Penn State, where he did advanced work in metallurgy. Mr. Evans began his foundry career in 1930 as a metallurgist and later transferred to sales. He joined Empire Steel Castings Inc. in 1940 as sales manager; has been with that company ever since. During the Korean War, Mr. Evans served the government in the Metallurgical and Conservation Branch of the National Production Authority. During 1953 and 1954, Mr. Evans was chief of the Castings Branch of the Business and Defense Services Administration.

Two new members named to the institute's board of directors are P. L. McCulloch Jr., president, Electro Alloys Division of American Brake Shoe Co., Elyria, O., and R. A. Hipke, secretary, Sivyer Steel Casting Co., Milwaukee.

In addition to reports of ACI's research work on cast heat-resistant and corrosion-resistant alloys, the following three talks were presented: "Outlook for Nickel Supply," by Theodore Monell, International Nickel Co. Inc., New York; "Government

Planning and the Foundry Industry", by Roger F. Waindle, chief, Castings Branch, BDSA, Washington, and "Know Your Costs," by Frank G. Steinebach, editor, FOUNDRY.

Air Pollution Control Group Meets To Elect Officers

Election of a new board president and six new directors of the Air Pollution Control Association was confirmed at the group's 49th annual meeting, in Buffalo May 21-24.

Benjamin Linsky, chief, Smoke Abatement Bureau, Detroit, succeeds H. Kenneth Kugel, chief engineer, Division of Smoke Regulation and Boiler Inspection, Washington, D. C., as president of APCA. Mr. Kugel remains on the board for the 1956-57 term.

Newly elected directors of the board are Albert A. Casey, Cleveland Electric Illuminating Co.; Robert L. Chass, Los Angeles County Air Pollution Control District; Leonard Greenburg, New York, Air Pollution Control; Dale H. Hutchinson, Stanford Research Institute; and Julian Tobey, Appalachian Coals Inc.

Milton Reizenstein, smoke abatement engineer, Baltimore, was elected first vice president. By board authorization, Louis E. Bunts, smoke regulation engineer, Akron, O., will fill the vacancy left by President Linsky.

Iron Output Steady in UK

Production of iron castings in the United Kingdom during the first quarter was almost the same as that of the preceding quarter and 2.6 per cent larger than in the 1955 period. The Council of Ironfoundry Associations, London, reports total output of gray and malleable iron castings in the three months was 1,039,670 tons, against 1,013,520 tons the year before.

"Wait'll Joe get's out'a the shower and discovers where he hung his stuff!"

Book Review

ASTM Standards 1955, *Part 2, Nonferrous Metals,* cloth, 1480 pages, 6 x 9 in., published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3. Price $11.

Contains over 270 formally adopted standards, tentative specifications, methods of test and definitions relating to nonferrous metals and alloys. Of those over 35 are devoted to castings.

The book is subdivided into sections relating to copper and copper alloys; nonferrous metals and their alloys; metallic materials for electrical heating, electrical resistance and electrical contacts; metal powders and metal powder products, electrodeposited metallic coatings; corrosion tests; die cast metals and alloys; aluminum and magnesium and their alloys, and general methods of testing.

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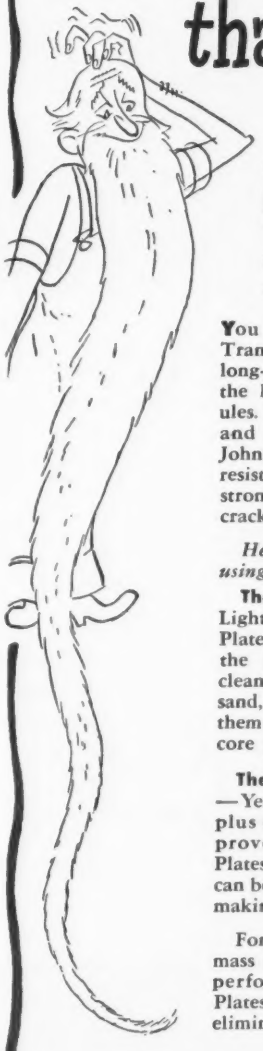

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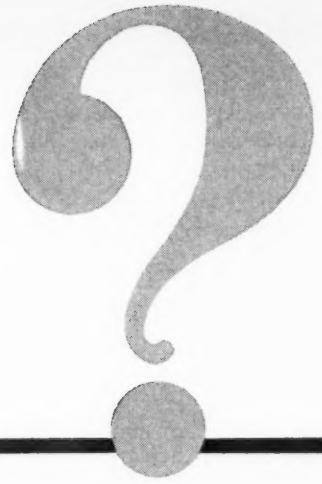

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Four management tests for advertising budgets?
The 42 check points in developing a budget?
The seven steps in the "Task Method?"
The twelve questions preceding a budget presentation?

These and other questions are covered in "How to Establish the Budget for Advertising Industrial Products"—Report Number Three of the Industrial Advertising Research Institute. This study, made exclusively for the Institute, is based on a survey of how 64 successful industrial companies developed their budgets.

RESEARCH BY AND FOR INDUSTRIAL MARKETERS

Other subjects related to industrial advertising have been or are being studied by Project Councils of the I.A.R.I. (See Box) Projects are planned and developed by teams of experienced industrial advertising and marketing men.

SHARING THE COST OF RESEARCH TO IMPROVE INDUSTRIAL ADVERTISING

The Institute was established in 1952 by the National Industrial Advertisers Association as a non-profit impartial organization to study means of increasing the efficiency of industrial advertising. Participating companies pay fees based on the size of their industrial advertising budget or the amount of business handled. This cooperation allows I.A.R.I. to undertake extensive studies. I.A.R.I. subscribing companies receive these studies.

Because hundreds of companies share in the cost, the Institute can retain experienced research organizations for all projects. All reports are sent to subscribers; and, since subscriptions are based on the size of the industrial advertising budget of the company, agency, publisher, or supplier, all share the benefits at nominal cost.

Write now for the new booklet, "The Door to Marketing Progress." It gives complete information on the Institute, its organization, work, and projects, details on costs and benefits and current list of subscribers.

REPORTS PUBLISHED

- Methods for Handling and Evaluating Inquiries
- Bibliography of Information on Handling Advertising Inquiries
- How to Establish the Budget for Advertising Industrial Products
- Yardsticks for Evaluating Industrial Advertising Research
- Organizing and Controlling the Industrial Advertising Operations

PROJECTS UNDER DEVELOPMENT

- Use of Market Evaluation Methods in Developing the Industrial Advertising Plan
- A Study of Expected Variation in Readership Scores of Paired Ads
- Evaluating Industrial Exhibits Techniques
- Establishing and Maintaining Direct Mail Lists
- Effective Coordination of Advertising and Sales in Marketing Industrial Products
- Application of Motivation Research to Industrial Advertising
- Techniques and Standards in Mail Readership Studies
- A Statistical Study of Copy Characteristics
- Audience Characteristics in Industrial Advertising Readership
- Grants-In-Aid for Research on Industrial Advertising in Universities and Colleges

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Table Converting Millimeters To Inches

Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.
1	0.03937	51	2.00787	101	3.97637	151	5.94487	201	7.91337	251	9.88187	301	11.85037	351	13.81887	401	15.78737	451	17.75587
2	0.07874	52	2.04724	102	4.01574	152	5.98424	202	7.95274	252	9.92124	302	11.88974	352	13.85824	402	15.82674	452	17.79521
3	0.11811	53	2.08661	103	4.05511	153	6.02361	203	7.99211	253	9.96061	303	11.92911	353	13.89761	403	15.86611	453	17.83461
4	0.15748	54	2.12598	104	4.09448	154	6.06298	204	8.03148	254	9.99998	304	11.96848	354	13.93698	404	15.90548	454	17.87398
5	0.19685	55	2.16535	105	4.13385	155	6.10235	205	8.07085	255	10.03935	305	12.00785	355	13.97635	405	15.94485	455	17.91335
6	0.23622	56	2.20472	106	4.17322	156	6.14172	206	8.11022	256	10.07872	306	12.01722	356	14.01572	406	15.98122	456	17.95272
7	0.27559	57	2.24409	107	4.21259	157	6.18109	207	8.14959	257	10.11809	307	12.08659	357	14.05509	407	16.02359	457	17.99209
8	0.31496	58	2.28346	108	4.25196	158	6.22046	208	8.18896	258	10.15746	308	12.12596	358	14.09446	408	16.06296	458	18.03146
9	0.35433	59	2.32283	109	4.29133	159	6.25983	209	8.22833	259	10.19683	309	12.16533	359	14.13383	409	16.10233	459	18.07383
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16	0.62992	66	2.59842	116	4.56692	166	6.53542	216	8.50392	266	10.47242	316	12.44092	366	14.40942	416	16.37792	466	18.34642
17	0.66929	67	2.63779	117	4.60629	167	6.57479	217	8.54329	267	10.51179	317	12.48029	367	14.44879	417	16.41729	467	18.38579
18	0.70866	68	2.67716	118	4.64566	168	6.61416	218	8.58266	268	10.55116	318	12.51966	368	14.48816	418	16.45666	468	18.42516
19	0.74803	69	2.71653	119	4.68503	169	6.65353	219	8.62203	269	10.59053	319	12.55903	369	14.52753	419	16.49603	469	18.46453
20	0.78710	70	2.75590	120	4.72440	170	6.69290	220	8.66140	270	10.62990	320	12.59840	370	14.56690	420	16.53540	470	18.50390
21	0.82677	71	2.79527	121	4.76377	171	6.73227	221	8.70077	271	10.66927	321	12.63777	371	14.60627	421	16.57477	471	18.54327
22	0.86614	72	2.83464	122	4.80314	172	6.77164	222	8.74014	272	10.70864	322	12.67714	372	14.64564	422	16.61414	472	18.58264
23	0.90551	73	2.87401	123	4.84251	173	6.81101	223	8.77951	273	10.74801	323	12.71651	373	14.68501	423	16.65351	473	18.62201
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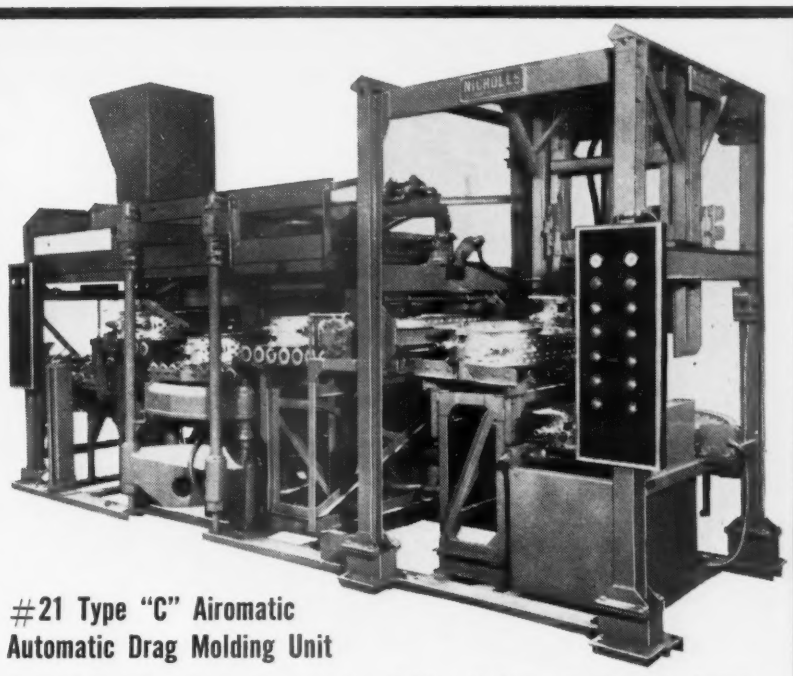
26	1.02362	76	2.99212	126	4.96062	176	6.92912	226	8.89762	276	10.86612	326	12.83462	376	14.80312	426	16.77162	476	18.74012
27	1.06299	77	3.03149	127	4.99999	177	6.96849	227	8.93699	277	10.90549	327	12.87399	377	14.84249	427	16.81099	477	18.77949
28	1.10236	78	3.07086	128	5.03936	178	7.00786	228	8.97636	278	10.94486	328	12.91336	378	14.88186	428	16.85036	478	18.81886
29	1.14173	79	3.11023	129	5.07873	179	7.04723	229	9.01573	279	10.98423	329	12.95273	379	14.92123	429	16.88973	479	18.85823
30	1.18110	80	3.14960	130	5.11810	180	7.08660	230	9.05510	280	11.02360	330	12.99210	380	14.96060	430	16.92910	480	18.89760
31	1.22047	81	3.18897	131	5.15747	181	7.12597	231	9.09447	281	11.06297	331	13.03147	381	14.99997	431	16.96847	481	18.93697
32	1.25984	82	3.22834	132	5.19684	182	7.16534	232	9.13384	282	11.10234	332	13.07084	382	15.03934	432	17.00784	482	18.97634
33	1.29921	83	3.26771	133	5.23621	183	7.20471	233	9.17321	283	11.14171	333	13.11021	383	15.07871	433	17.04721	483	19.01571
34	1.33858	84	3.30708	134	5.27558	184	7.24408	234	9.21258	284	11.18108	334	13.14958	384	15.11808	434	17.08658	481	19.05508
35	1.37795	85	3.34645	135	5.31495	185	7.28345	235	9.25195	285	11.22045	335	13.18895	385	15.15745	435	17.12595	485	19.09445
36	1.41732	86	3.38582	136	5.35132	186	7.32282	236	9.29132	286	11.25982	336	13.22832	386	15.19682	436	17.16532	486	19.13382
37	1.45669	87	3.42519	137	5.39369	187	7.36219	237	9.33069	287	11.29919	337	13.26769	387	15.23619	437	17.20469	487	19.17319
38	1.49606	88	3.46456	138	5.43306	188	7.40156	238	9.37006	288	11.33856	338	13.30706	388	15.27556	438	17.24406	488	19.21256
39	1.53543	89	3.50393	139	5.47243	189	7.44093	239	9.40943	289	11.37793	339	13.34643	389	15.31493	439	17.28343	489	19.25193
40	1.57480	90	3.54330	140	5.51180	190	7.48030	240	9.44880	290	11.41730	340	13.38580	390	15.35430	440	17.32280	490	19.29130
41	1.61417	91	3.58267	141	5.55117	191	7.51967	241	9.48817	291	11.45667	341	13.42517	391	15.39367	441	17.36217	491	19.33037
42	1.65354	92	3.62204	142	5.59054	192	7.55904	242	9.52754	292	11.49604	342	13.46454	392	15.43304	442	17.40154	492	19.37001
43	1.69291	93	3.66141	143	5.62991	193	7.59841	243	9.56691	293	11.53541	343	13.50391	393	15.47241	443	17.44091	493	19.40911
44	1.73228	94	3.70078	144	5.66928	194	7.63778	244	9.60628	294	11.57478	344	13.54328	394	15.51178	444	17.48028	494	19.44878
45	1.77165	95	3.74015	145	5.70865	195	7.67715	245	9.64565	295	11.61415	345	13.58265	395	15.55115	445	17.51965	495	19.48815
46	1.81102	96	3.77952	146	5.74802	196	7.71652	246	9.68502	296	11.65352	346	13.62202	396	15.59052	446	17.55902	496	19.52752
47	1.85039	97	3.81889	147	5.78739	197	7.75589	247	9.72439	297	11.69289	347	13.66139	397	15.62989	447	17.59839	497	19.56689
48	1.88976	98	3.85826	148	5.82676	198	7.79526	248	9.76376	298	11.73226	348	13.70076	398	15.66926	448	17.63776	498	19.60626
49	1.92913	99	3.89763	149	5.86613	199	7.83163	249	9.80313	299	11.77163	349	13.74013	399	15.70863	449	17.67713	499	19.64563
50	1.96850	100	3.93700	150	5.90550	200	7.87400	250	9.84250	300	11.81100	350	13.77950	400	15.74800	450	17.71650	500	19.68500

Table Converting Millimeters To Inches

Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.
501	19.72437	551	21.69287	601	23.66137	651	25.62987	701	27.59837	751	29.56687	801	31.53537	851	33.50387	901	35.47237	951	37.44087
502	19.76374	552	21.73224	602	23.70074	652	25.66924	702	27.63774	752	29.60624	802	31.57474	852	33.54324	902	35.51174	952	37.48024
503	19.80311	553	21.77161	603	23.74011	653	25.70861	703	27.67711	753	29.64561	803	31.61411	853	33.58261	903	35.55111	953	37.51961
504	19.84248	554	21.81098	604	23.77948	654	25.74798	704	27.71648	754	29.68498	804	31.65348	854	33.62198	904	35.59048	954	37.55898
505	19.88185	555	21.85035	605	23.81885	655	25.78735	705	27.75585	755	29.72135	805	31.69285	855	33.66135	905	35.62985	955	37.59835
506	19.92122	556	21.88972	606	23.85822	656	25.82672	706	27.79522	756	29.76372	806	31.73222	856	33.70072	906	35.66922	956	37.63772
507	19.96059	557	21.92909	607	23.89759	657	25.86609	707	27.83459	757	29.80309	807	31.77159	857	33.74009	907	35.70859	957	37.67709
508	19.99996	558	21.96846	608	23.93696	658	25.90546	708	27.87396	758	29.84246	808	31.81096	858	33.77946	908	35.74796	958	37.71646
509	20.03933	559	22.00783	609	23.97633	659	25.94483	709	27.91333	759	29.88183	809	31.85033	859	33.81883	909	35.78733	959	37.75583
510	20.07870	560	22.04720	610	24.01570	660	25.98420	710	27.95270	760	29.92120	810	31.88970	860	33.85820	910	35.82670	960	37.79520
511	20.11807	561	22.08657	611	24.05507	661	26.02357	711	27.99207	761	29.96057	811	31.92907	861	33.89757	911	35.86607	961	37.83457
512	20.15744	562	22.12594	612	24.09444	662	26.06294	712	28.03144	762	29.99994	812	31.96844	862	33.93694	912	35.90544	962	37.87394
513	20.19681	563	22.16531	613	24.13381	663	26.10231	713	28.07081	763	30.03931	813	32.00781	863	33.97631	913	35.94481	963	37.91331
514	20.23618	564	22.20468	614	24.17318	664	26.14168	714	28.11018	764	30.07868	814	32.04718	864	34.01568	914	35.98118	964	37.95268
515	20.27555	565	22.24405	615	24.21255	665	26.18105	715	28.14955	765	30.11805	815	32.08655	865	34.05505	915	36.02355	965	37.99205
516	20.31492	566	22.28342	616	24.25192	666	26.22042	716	28.18892	766	30.15742	816	32.12592	866	34.09442	916	36.06292	966	38.03142
517	20.35429	567	22.32279	617	24.29129	667	26.25979	717	28.22829	767	30.19679	817	32.16529	867	34.13379	917	36.10229	967	38.07079
518	20.39366	568	22.36216	618	24.33066	668	26.29916	718	28.26766	768	30.23616	818	32.20466	868	34.17316	918	36.14166	968	38.11016
519	20.43303	569	22.40153	619	24.37003	669	26.33853	719	28.30703	769	30.27553	819	32.24403	869	34.21253	919	36.18103	969	38.14953
520	20.47240	570	22.44090	620	24.40940	670	26.37790	720	28.34640	770	30.31490	820	32.28340	870	34.25190	920	36.22040	970	38.18890
521	20.51177	571	22.48027	621	24.44877	671	26.41727	721	28.38577	771	30.35427	821	32.32277	871	34.29127	921	36.25977	971	38.22827
522	20.55114	572	22.51964	622	24.48814	672	26.45664	722	28.42514	772	30.39364	822	32.36214	872	34.33064	922	36.29914	972	38.26764
523	20.59051	573	22.55901	623	24.52751	673	26.49601	723	28.46451	773	30.43301	823	32.40151	873	34.37001	923	36.33851	973	38.30701
524	20.62988	574	22.59838	624	24.56688	674	26.53538	724	28.50388	774	30.47238	824	32.44088	874	34.40938	921	36.37788	974	38.34638
525	20.66925	575	22.63775	625	24.60625	675	26.57475	725	28.54325	775	30.51175	825	32.48025	875	34.44875	925	36.41725	975	38.38575
526	20.70862	576	22.67712	626	24.64562	676	26.61412	726	28.58262	776	30.55112	826	32.51962	876	34.48812	926	36.45662	976	38.42512
527	20.74799	577	22.71649	627	24.68499	677	26.65349	727	28.62199	777	30.59049	827	32.55899	877	34.52749	927	36.49599	977	38.46449
528	20.78736	578	22.75586	628	24.72436	678	26.69286	728	28.66136	778	30.62986	828	32.59836	878	34.56686	928	36.53536	978	38.50386
529	20.82673	579	22.79523	629	24.76373	679	26.73223	729	28.70073	779	30.66923	829	32.63773	879	34.60623	929	36.57473	979	38.54323
530	20.86610	580	22.83460	630	24.80310	680	26.77160	730	28.74010	780	30.70860	830	32.67710	880	34.64560	930	36.61410	980	38.58260
531	20.90547	581	22.87397	631	24.84247	681	26.81097	731	28.77947	781	30.74797	831	32.71647	881	34.68497	931	36.65347	981	38.62197
532	20.94484	582	22.91334	632	24.88184	682	26.85034	732	28.81884	782	30.78734	832	32.75584	882	34.72434	932	36.69284	982	38.66134
533	20.98421	583	22.95271	633	24.92121	683	26.88971	733	28.85821	783	30.82671	833	32.79521	883	34.76371	933	36.73221	983	38.70071
534	21.02358	584	22.99208	634	24.96058	684	26.92908	734	28.89758	781	30.86608	834	32.83458	884	34.80308	934	36.77158	984	38.74008
535	21.06295	585	23.03145	635	24.99995	685	26.96845	735	28.93695	785	30.90545	835	32.87395	885	34.84245	935	36.81095	985	38.77945
536	21.10232	586	23.07082	636	25.03932	686	27.00782	736	28.97632	786	30.94482	836	32.91332	886	34.88182	936	36.85032	986	38.81882
537	21.14169	587	23.11019	637	25.07869	687	27.04719	737	29.01569	787	30.98419	837	32.95269	887	34.92119	937	36.88969	987	38.85819
538	21.18106	588	23.14956	638	25.11806	688	27.08656	738	29.05506	788	31.02356	838	32.99206	888	34.96056	938	36.92906	988	38.89756
539	21.22043	589	23.18893	639	25.15743	689	27.12593	739	29.09443	789	31.06293	839	33.03143	889	34.99993	939	36.96843	989	38.93693
540	21.25980	590	23.22830	640	25.19680	690	27.16530	740	29.13380	790	31.10230	840	33.07080	890	35.03930	940	37.00780	990	38.97630
541	21.29917	591	23.26767	641	25.23617	691	27.20467	741	29.17317	791	31.14167	841	33.11017	891	35.07867	941	37.04717	991	39.01567
542	21.33854	592	23.30704	642	25.27554	692	27.24404	742	29.21254	792	31.18104	842	33.14954	892	35.11804	942	37.08654	992	39.05504
543	21.37791	593	23.34641	643	25.31491	693	27.28341	743	29.25191	793	31.22041	843	33.18891	893	35.15741	943	37.12591	993	39.09441
544	21.41728	594	23.38578	644	25.35428	694	27.32278	744	29.29128	794	31.25978	844	33.22828	894	35.19678	944	37.16528	994	39.13378
545	21.45665	595	23.42515	645	25.39365	695	27.36215	745	29.33068	795	31.29915	845	33.26765	895	35.23615	945	37.20465	995	39.17315
546	21.49602	596	23.46452	646	25.43302	696	27.40152	746	29.37002	796	31.33852	846	33.30702	896	35.27552	946	37.24402	996	39.21252
547	21.53539	597	23.50389	647	25.47239	697	27.44089	747	29.40939	797	31.37789	847	33.34639	897	35.31489	947	37.28339	997	39.25189
548	21.57476	598	23.54326	648	25.51176	698	27.48026	748	29.44876	798	31.41726	848	33.38576	898	35.35426	948	37.32276	998	39.29126
549	21.61413	599	23.58263	649	25.55113	699	27.51963	749	29.48813	799	31.45663	819	33.42513	899	35.39363	949	37.36213	999	39.33063
550	21.65350	600	23.62200	650	25.59050	700	27.55900	750	29.52750	800	31.49600	850	33.46450	900	35.43300	950	37.40150	1.000	39.37000

- **INCREASE** production . . .
- **SAVE** manhours . . .
- **GET** quality molds with the new



#21 Type "C" Airomatic Automatic Drag Molding Unit

Heavy Duty Jolt & Power Squeezer Drag Molding Machine with Pneumatic Pattern Draw. Equipped with air operated car type squeeze head and built-in flask roll-in and mold roll-out device with measuring sand hopper, flask indexing device and sand spill upset, flask feed-in elevator, mold turn-over and mold transfer.

NICHOLLS AIROMATIC

Nicholls has harnessed this molding machine's own driving force **airomatically** to give you a **better** job at **less** cost. There are no limit switches, no electrical timers, no electric pressure switches, no electrical latch relays, just **dependable,** reliable "push-button" air-to-air control throughout.

Yes, the new NICHOLLS AIROMATIC molding equipment makes, closes, removes and returns **consistent high-quality** molds **continuously . . . automatically.** It represents the acme of simplicity for the automatic production of high quality and high quantity mass produced sand molds.

Check **your** equipment **today.** Whatever your system, there's a Nicholls machine to fit the job. For information call or write

WM. H. NICHOLLS CO., INC.
Richmond Hill 18, Long Island, N. Y.

Compare this... with your **present equipment**

Can You

1. Push your "Stop" button and then after a pause, push your "Start" button and have your equipment continue with the next phase?
2. Push your "Stop" button and then after pushing several "Manual" buttons for subsequent phases, push the "Start" button and have your equipment continue automatically with the next phase?
3. Use a particular "Manual" button to pinch-hit in an emergency for a failed automatic phase in finishing out a molding shift?
4. Get 240 molds per hour (one every 15 seconds) hour after hour, shift after shift, day after day?

You CAN with a NICHOLLS AIROMATIC!

NICHOLLS

• FOR HALF A CENTURY THE BEST IN MOLDING EQUIPMENT

Circle 706 on Inquiry Card—Page 201

The Shakeout

Buff Is Impregnated with Abrasive Grains

A COOKING WARE MANUFACTURER has buff-polished as many as 29,000 square and round cast aluminum frying pans with a pleated-type, sectional, impregnated abrasive buff mounted on a spindle. Previously,

other buffing products of comparable size buffed no more than 12,000 round pans.

A product of Carborundum Co., Niagara Falls, N. Y., the new buffs are engineered of specially treated biased cloth and are impregnated with selected abrasive grains bonded throughout their entire construction. This type of construction is said to reduce cost considerably. Buffs with various fine or coarse grits are available.

For More Details Circle No. 443—Page 201

Shell Mold System Will Be Installed

THIS SHELL MOLDING SYSTEM, which is capable of producing 240 shells per hour, was part of 67,000 lb of equipment exhibited by Link-Belt Co., Chicago, at the

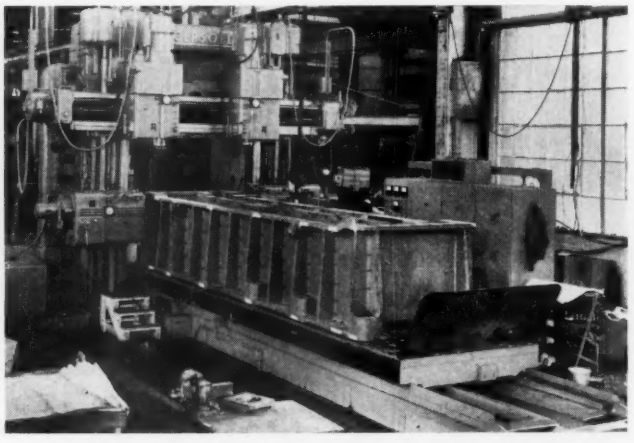
AFS convention in Atlantic City, May 3-9. It was purchased by Evinrude Motors Division, Outboard Marine & Mfg. Co., Milwaukee, which expects to install it for production of crankshafts this fall, as one phase of a $5½ million expansion program.

The system consists of a four-station shell molding machine, closing machine, sand-resin handling equipment, drives and controls. It offers a completely automatic operation in one unit.

For More Details Circle No. 444—Page 201

Milling Machine Handles 20-Ton Casting

FIRST CASTING to be milled on a new Ingersoll machine recently installed at Wheeling Works, Continental Division, Blaw-Knox Co., Wheeling, W. Va., is this 40,000-lb bottom drive case for a wide-flange beam straightener.



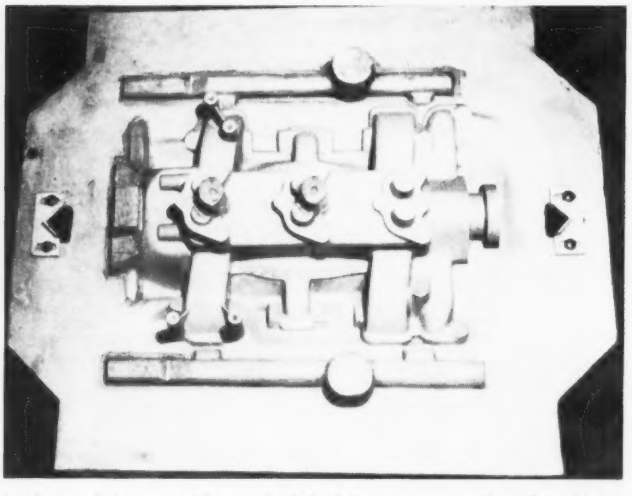
The giant new machine is a 72-in. x 84-in. x 24-ft, four-head, adjustable rail planer type miller It is equipped with 100-hp drive which can be applied to any one of the two side or rail heads or quartered to each.

For More Details Circle No. 445—Page 201

Matchplates Are Made of Plastic

THE MATCHPLATE in the accompanying illustration is one of many which have been fabricated with tooling plastics made by Furane Plastics Inc., Los Angeles. It was made by Reinforced Plastic Tooling, Huntington Park, Calif. Liquid resin and hardener combine at room temperature to form a hard, machinable surface.

The material is said to be easy to work with hand



tools and to provide a shrink-free, room-curing hardener and resin combination. It reportedly duplicates existing metal patterns in perfect detail and holds rigid tolerances.

For More Details Circle No. 446—Page 201

COLUMBIA-SOUTHERN

SODA BRIQUETTES® for faster, better desulphurizing

The size and shape of Columbia-Southern Soda Briquettes have been scientifically designed to do a faster, better desulphurizing job in Blast Furnace and Foundry operations.

The walnut form exposes maximum surface area and it is a known fact that such maximum contact is a highly important factor in determining the percentage of sulphur reduction.

Aside from speedy and efficient desulphurization, Columbia-Southern Soda Briquettes accelerate production, increase fluidity, quicken the release of gases and impurities, allow for automatic slag skimming, and improve the refining value of the iron.

Order your supply today by name "Columbia-Southern Soda Briquettes." Packed in 100 lb. paper bags; easy to handle and store.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
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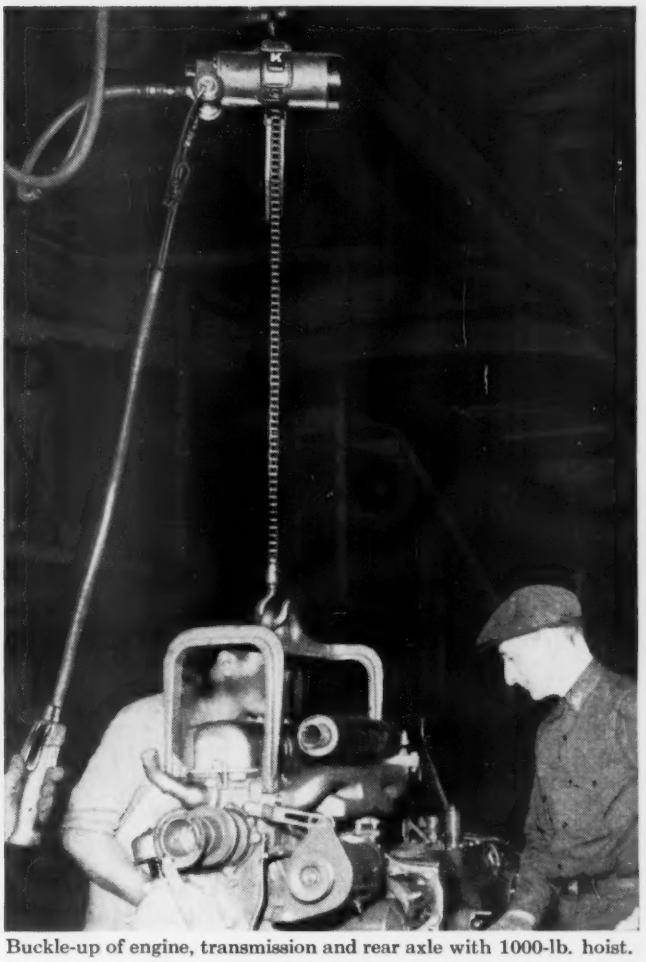
IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

Circle 707 on Inquiry Card—Page 201



Buckle-up of engine, transmission and rear axle with 1000-lb. hoist.

ACCURATE CONTROL
from swift lift to slow set

Keller Tool Air Hoists know when to get going or take it easy. The sensitive, hand control valve gives you smooth-as-silk operation.

CHOOSE YOUR MODEL. THEY'RE ALL KELLER TOOL QUALITY.

- **CANNOT BURN OUT** from overloading or stalling.
- **LIGHT WEIGHT**—easy to move and hang.
- **LOW MAINTENANCE**—rugged air motor not affected by dust and fumes.
- **CONTROLLED SPEED**—from a creep to maximum aids load spotting.

Model	Capacity	Speed	Weight
86-2V20	2000 lb.	19 f.p.m.	78 lb.
86-2V20L*	2000 lb.	19 f.p.m.	78 lb.
86-2V10	1000 lb.	35 f.p.m.	78 lb.
86-1V10	1000 lb.	19 f.p.m.	28 lb.
86-1V10L*	1000 lb.	19 f.p.m.	28 lb.
86-1V5A	500 lb.	35 f.p.m.	28 lb.
86-1V3	300 lb.	80 f.p.m.	28 lb.

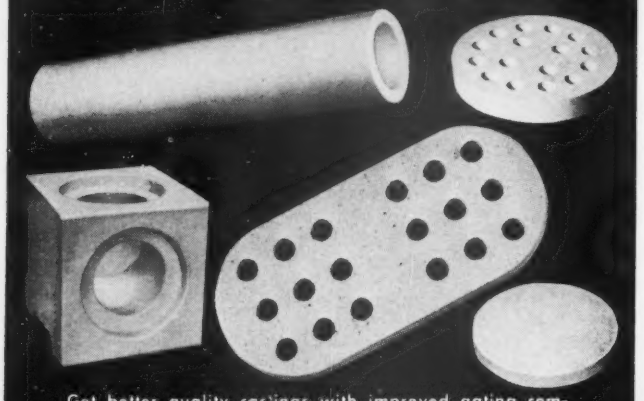
** Models with link chains*

Ask for Bulletin 86

GARDNER-DENVER
KELLER TOOL division, Grand Haven, Michigan
THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

Circle 708 on Inquiry Card—Page 201

UNIVERSAL
CUSTOM-MADE GATE REFRACTORIES



Get better quality castings with improved gating components. Universal refractory strainer cores, pouring pipes, splash cores and elbows are available in standard sizes or can be custom-made to your specifications. In addition, special strainer cores are available for high-manganese bronze.

Send specifications for price and delivery quotation. No obligation. Phone: SAndusky 4631.

UNIVERSAL CLAY PRODUCTS CO.

1515 EAST FIRST ST. • SANDUSKY, OHIO

Circle 709 on Inquiry Card—Page 201

REJECTS and SCRAP
due to gas are practically eliminated by . . . Model 400 VACUUM DEGASSING CHAMBER

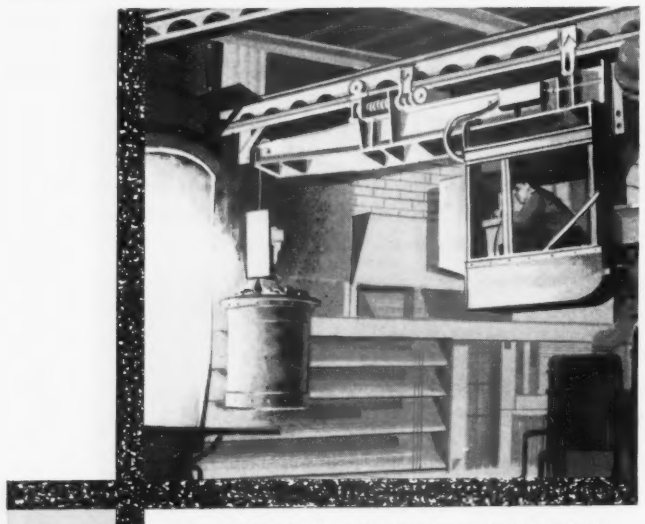
A compact, easily operated, entirely integrated foundry unit thoroughly degasses both ferrous and non-ferrous molten metals in a few minutes.

Complete package unit — requires no process changes — occupies small floor space — no special foundation — easily moved — requires no special experience or training.
Built-in lifting device
Ruggedly built for foundry service.

This Vacuum Degassing Unit permits profitable operation from the first day. Write for illustrated bulletin.

CENTRIFUGAL CASTING MACHINE CO.
P. O. Box 947 Tulsa 1, Oklahoma

Circle 711 on Inquiry Card—Page 201



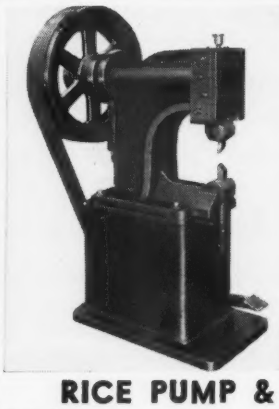
FOUNDRY INSTALLATIONS

Commercial Contracting Corporation has installed or modernized foundries for all the major automotive producers. Utilize this experience to up-date your own foundry facilities.

Write for information

COMMERCIAL CONTRACTING CORPORATION
GENERAL CONTRACTORS
12160 CLOVERDALE • DETROIT 4, MICHIGAN

Circle 710 on Inquiry Card—Page 201



MILWAUKEE-TESSMER
Sprue Cutter
for
Non-Ferrous Foundries

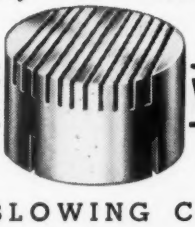
- Cuts Sprues and Gates with One, Swift, Sure Stroke.
- Does away with tedious hand labor.
- Speeds flow of work through cleaning department.
- Built for years of Rugged, Low-Cost Service.
- 2 Sizes, ¾" and 1¼" square. Built-in electric motor or belt drive.

Write for Illustrated Bulletin

RICE PUMP & MACHINE CO.
222 Park Ave., Belgium, Wis.

Circle 712 on Inquiry Card—Page 201

BE PREPARED TO HAVE
BETTER CORES
By Inserting



SMILLIE VENTS

FOR BLOWING CORES
Sizes from ⅛" to 1" in 1/16" steps Samples upon request

C. M. SMILLIE & CO.
1124 Woodward Heights Ferndale 20, Mich.

Circle 713 on Inquiry Card—Page 201

JOB ENGINEERED

FOR ALL DAY PRODUCTION POURING

Industrial ladles and pouring equipment have been Job Engineered to meet the demands of heavy duty production pouring—where large numbers of the same casting are turned out on a production line basis.

In this type of foundry operation, ladles get severe treatment. They are in continuous service all day long—never getting a chance to cool. After a day of heavy production pouring, Industrial ladles still operate easily, accurately and dependably—without binding as a result of heat distortion of ladle bowl. They pour more metal per day—safer—with less man power.

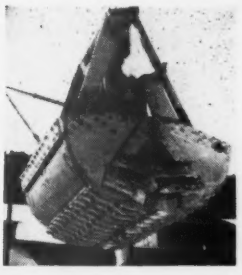
This Job Engineered ruggedness means greater profits for every foundry—large or small—whether it does production pouring or not. Send your pouring problems to Industrial Equipment Company—manufacturer of a complete line of standard and custom pouring and handling equipment—Bowls . . . Shanks . . . Bails . . . Tongs. Write today for latest catalog.

Industrial
EQUIPMENT COMPANY
115 OHIO ST., MINSTER, OHIO

Circle 714 on Inquiry Card—Page 201

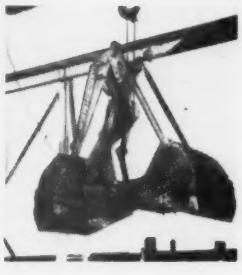
HOW TO MEET FOUR COMMON FOUNDRY BUCKET REQUIREMENTS

BLAW-KNOX "SHARK TOOTH" BUCKETS HANDLE COKE WITH MINIMUM DEGRADATION



Use this versatile *dual-purpose* bucket for efficient coke handling. Without the liner plates, the shark teeth literally finger their way through the coke so it can be handled with minimum degradation. Hook-on feature permits quick change for other foundry service requirements.

BLAW-KNOX "SHARK TOOTH" BUCKETS *with liner plates* HANDLE SAND WITH MINIMUM LEAKAGE



This open head type Single-Line Hook-On Bucket *with liner plates attached* inside of the shark teeth, economically handles sand, coal, small limestone and granular fines with minimum leakage!

BLAW-KNOX SINGLE-LINE HOOK-ON TYPE BUCKETS FOR EXTREMELY LOW HEADROOM

This Single-Line Hook-On Bucket solves rehandling problems when headroom is extremely limited. The ¾ yd. capacity bucket requires only 6'7" operating headroom. Also available in larger sizes.

BLAW-KNOX SINGLE-LINE HOOK-ON TYPE BUCKETS FOR AVERAGE HEADROOM

There is a type and size of Blaw-Knox Single-Line Hook-On Foundry Bucket to meet a wide range of operating conditions. Blaw-Knox can best give you the competent engineering service that makes possible selection of the bucket best suited to your requirements.

Get complete details from BULLETIN 2232.

BLAW-KNOX COMPANY
BLAW-KNOX EQUIPMENT DIVISION
Pittsburgh 38, Pa.
Offices in Principal Cities

BLAW-KNOX FOUNDRY BUCKETS

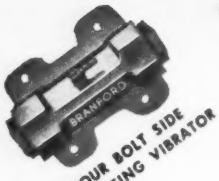
BLAW-KNOX

THE MOST COMPLETE RANGE OF SIZES AND TYPES

Circle 715 on Inquiry Card—Page 201

The Trademark of Quality Products

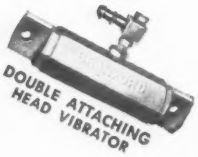
Since 1915



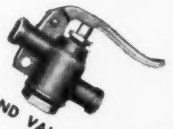
FOUR BOLT SIDE MOUNTING VIBRATOR

HOSE CLAMP

TWO BOLT SIDE MOUNTING VIBRATOR


DOUBLE ATTACHING HEAD VIBRATOR

1915
BRANFORD
VIBRATORS
USA


HAND VALVE

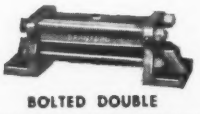
RENEWABLE NOZZLE CLEANER & SPRAYER

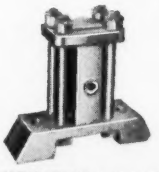
CLEANER & SPRAYER

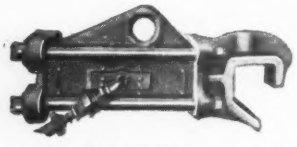
HOSE NIPPLE

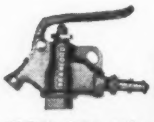
STARTING VALVE

HOSE ELBOW


BOLTED DOUBLE ATTACHING HEAD VIBRATOR


END MOUNTING VIBRATOR


FLASK RAPPER


BLOW GUN 450

The **BRANFORD** *Company*
CONTINUING NEW HAVEN VIBRATOR COMPANY
130 CHESTNUT STREET, NEW HAVEN, CONN.

Circle 716 on Inquiry Card—Page 201

INDICATING CALIPERS

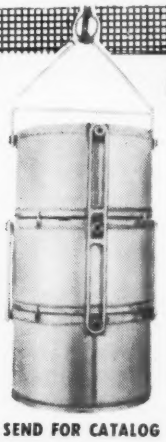
An effective method of taking over-rim Stock indicating calipers made in: measurements of castings, forgings, etc.

2" capacity-graduated in 1/100"
3" " " " 1/64"
50 MM " " " 1/5 MM
75 MM " " " 1/2 MM

Write for descriptive folder with full-size illustrations.

INDICATING CALIPERS CORP.
1359 York Ave., N. Y. 21, N. Y. Cable address: INDCALIPER Tel. LEhigh 5-0660

Circle 717 on Inquiry Card—Page 201



for **HEAT TREATING—BAKING —ANNEALING FIXTURES**

Call Wiretex **BASKETS MUFFLES • SCREENS • GRIDS RACKS • ETC.**

Every Weave, Alloy, Size, Load, Process and Quantity.

STANDARDS or CUSTOM MADE TO YOUR SPECIFICATIONS.

Wiretex mfg. co.

SEND FOR CATALOG 26 Mason St., Bridgeport 5, Conn.

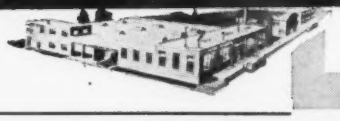
Circle 718 on Inquiry Card—Page 201

the right answer for every casting job

SUPERIOR CASTING ALLOYS

HENNING BROS. & SMITH, INC.

"Dependable service since 1922"
91-125 Scott Ave. at Randolph St., Brooklyn, N. Y.
HYacinth 7-3470-1, 2, 3



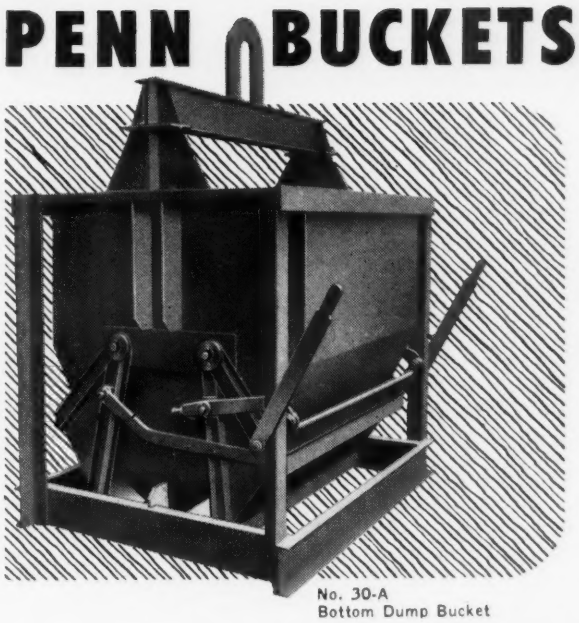
Brass • Bronze
Aluminum
Zinc • Lead • Tin
Zinc & Cadmium Anodes

Special alloys to meet the most exacting requirements of engineer and caster.

Laboratory controlled production. Shipments strapped on consumable pallets.

Circle 719 on Inquiry Card—Page 201

PENN BUCKETS



No. 30-A
Bottom Dump Bucket

Exclusive design makes this bottom dump bucket easy to operate . . . easy to open. Efficient for foundry use in handling all types of sand, moulding or core, dry or prepared. Can be used with coke, scrap iron and castings also. Sizes 7 to 200 cu. ft.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION MEMBER FEMA

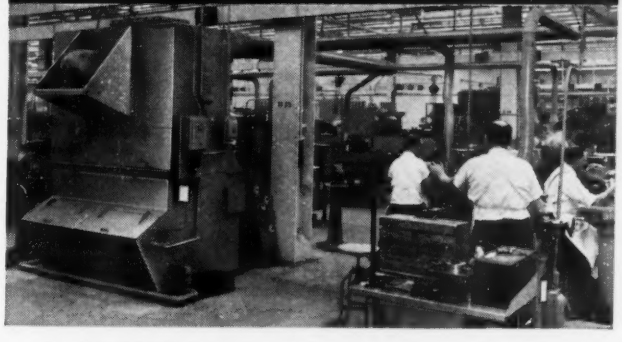
Write Today for Catalog • Prices Quoted on Application

PENN IRON WORKS, INC.
READING, PENNA.

Circle 720 on Inquiry Card—Page 201

NEWCOMB-DETROIT EST. 1912

- INDUSTRIAL OVENS
- DUST COLLECTORS
- SPRAY BOOTHS
- PARTS WASHERS



UNI-WASH DUST COLLECTORS

Compact, complete recirculating Water-Type Dust Collectors for industrial processing dusts. Dirt is collected as wet sludge which may be carried away automatically. No moving parts. Extremely efficient for grinding operations. Eliminates danger of explosion from magnesium and aluminum dust. Proven in foundries. Standard Units available.

For Bulletins and Quotations, write to:

NEWCOMB-DETROIT
5755 RUSSELL ST. • DETROIT 11, MICH.

Circle 721 on Inquiry Card—Page 201

For Better Aluminum AT LOWER COST

B&A POTASSIUM TITANIUM FLUORIDE
(K_2TiF_6)

Many Advantages

When making aluminum castings, the use of B&A Potassium Titanium Fluoride results in finer grain structure, with improved yield and tensile strength, greater elongation and better machinability . . . all leading to lower production costs, better products!

Low-Cost Way of Adding Titanium

The incorporation of titanium into aluminum alloys may be accomplished more economically with Potassium Titanium Fluoride than with other methods.

Adding Potassium Titanium Fluoride

Where temperatures are in the range of 1400°F, the Potassium Titanium Fluoride may be added straight or, if lower operating temperatures are employed, a mixture of this salt with Potassium Fluoborate, which has a lower melting point than straight Potassium Titanium Fluoride, may be used.

And . . . Investigate B&A Alkali Fluoborates

B&A Alkali Fluoborates are easily-handled purifying salts which the foundryman can use like precision tools for a wide range of purposes when casting magnesium, or when refining, melting or heat-treating aluminum.

For information on these high purity chemicals, call or write any of the Baker & Adamson offices listed below.

GC Allied Chemical

REAGENTS B&A STANDARD OF PURITY FINE CHEMICALS

BAKER & ADAMSON® *Fine Chemicals*
GENERAL CHEMICAL DIVISION
Allied Chemical & Dye Corporation
40 Rector Street, New York 6, N. Y.

Offices: Albany* • Atlanta • Baltimore* • Birmingham* • Boston* • Bridgeport* Buffalo* • Charlotte* • Chicago* • Cleveland* • Denver* • Detroit* • Houston* Jacksonville • Kalamazoo • Los Angeles* • Milwaukee • Minneapolis • New York* Philadelphia* • Pittsburgh* • Providence* • St. Louis* • San Francisco* • Seattle Kennewick* and Yakima (Wash.)

In Canada: The Nichols Chemical Company, Limited - Montreal* - Toronto* - Vancouver*

SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

*Complete stocks carried here

Circle 722 on Inquiry Card—Page 201

SCHNEIBLE

Whether your foundry is a David or Goliath

A Schneible Dust Control System will fill your needs

Schneible equipment for the control of dust, fumes and vapors is designed for all foundries, small or large.

More than twenty years of experience in the solving of varied problems of foundry air pollution go into every collector manufactured by Schneible.

Recent improvements in design and application make the Schneible Multi-Wash a most efficient and economical unit. These design changes now allow you to own the absolute best in wet dust collection equipment at a greatly reduced cost per 1,000 CFM of air handled.

Schneible Multi-Wash Collectors are easy to service. There are no moving parts, no spray nozzles to plug, nothing to freeze, and a simple flushing with a fire hose a few times a year gives you long maintenance-free service.

Write TODAY for our new literature on the Multi-Wash Collectors.

SCHNEIBLE

Claude B. Schneible Company
P.O. Box 81, North End Station
Detroit 2, Michigan • Phone TRinity 5-8212

Name _____
Title _____
Company _____
Address _____
City _____ Zone ____ State _____

SERVING FOUNDRYMEN THE WORLD OVER

Circle 723 on Inquiry Card—Page 201

OLIVER Double Arbor Saw

Bench rips, cross-cuts, miters patterns quickly!

Adjusted in a jiffy to each operation . . . saves time and cuts costs

This double-duty Saw Bench saves pattern shops valuable time. A shaftless motor is built directly on each of the two saw arbors. Either rip saw or cross-cut saw can be brought into action by turning the handwheel. Saw arbor tilts up to 45°. Arbors can be adjusted vertically. Rips up to 24¼" wide, cross-cuts up to 36" wide. A 16-inch saw projects 3¼" through table. Dadoes up to 4" wide. Cuts a perfect miter. Has the most complete and accurate set of gauges. Write for Bulletin No. 260-D.

Oliver makes a complete line of the finest Saw Benches, Pattern Lathes and other woodworking machines for pattern shops. Write for full details.

OLIVER MACHINERY COMPANY
Established 1890 **GRAND RAPIDS 2, MICH.**

Circle 724 on Inquiry Card—Page 201

No. 4 DAYTON RING VALVE BENCH

RAMMER

MORE POWER—MORE SPEED

You'll get more production with these faster, more powerful rammers and at the same time substantially reduce maintenance costs.

The Valve Units will last for years. The Cylinder Bores and Piston Rods are HARD CHROME PLATED which doubles the life of the Rammer. Many of the largest foundries in the country have already adopted them as standard. Made in six sizes to meet every requirement.

Send for Bulletin 300

DAYTON PNEUMATIC TOOL CO.

Manufacturers of Pneumatic Tools Since 1903

DAYTON, OHIO

Circle 725 on Inquiry Card—Page 201

Zircon Sand
Zircon Flour
Silica

BERKSHIRE

Potassium
Titanium
Fluoride

Potassium
Zirconium
Fluoride

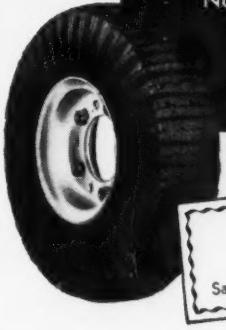
BERKSHIRE CHEMICALS, INC.
420 LEXINGTON AVENUE • NEW YORK 17
55 New Montgomery St. • San Francisco 5, Cal.
Innis Speiden Company Division
New York • Philadelphia • Boston • Cleveland • Chicago

Circle 726 on Inquiry Card—Page 201

HOW MUCH IS "DOWN-TIME" COSTING YOU?

NO FLATS WITH **MITCO** INDUSTRIAL TIRES!

No work stoppage caused by punctures or blowouts!



Try a Set of **MITCO'S** Satisfaction Guaranteed!

Replaces conventional pneumatic tires on Payloaders, Fork Trucks, Tractors, Industrial Carts and other Industrial Equipment.

LOAD CAPACITY equal to the heaviest ply pneumatic tire.

TRACTION far superior to any continuous tread tire. Mitco Tires have sure-grip tread.

RESILIENCY of the Mitco Tire compares favorably with pneumatic tires.

STEERING is easier, more accurate, when industrial equipment has Mitco Tires.

Write or wire us for Nearest Distributor

MITCHELL INDUSTRIAL TIRE COMPANY, INC.
P. O. Box 468, Chattanooga, Tennessee • Phone TAylor 1-7531

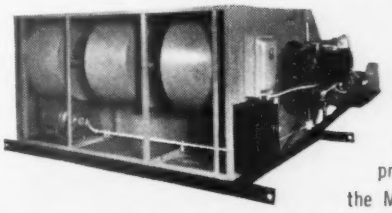
Circle 727 on Inquiry Card—Page 201

Here's
How to END Heating Problems
IN YOUR PLANT!

Tempering Make-up Air? Drying?
Space Heating?

If your plant faces expansion . . . or if you plan to build new plants . . . let National Heater Company show you how you can solve your space heating and ventilating problems **efficiently** and **economically.** No matter how large or small your plant may be, National Champion Heaters **save** you money on installation, operation and maintenance.

NATIONAL *Champion*
DIRECT FIRED HEATERS



Where space is a prime consideration, the Model C, horizontal ceiling suspension unit — illustrated above — is unexcelled. It tucks away in the rafters of your plant.

6 Models 66 Sizes 400,000 to 2,000,000 BTU'S
Automatic Operation PLUS Year-Round VENTILATING!
Direct-fired for gas, oil and combination fuels.
Approved by American Gas Association. Listed by Underwriters Laboratory.

Here's National Heater's **2-WAY OFFER:**

1. Complete file of National Champion's 1956 line of direct-fired space heaters.
2. A personal visit to discuss your plant's heating needs by a qualified National Champion representative. Representatives in 44 cities coast to coast.

NO OBLIGATION! MAIL THIS COUPON TODAY!

NATIONAL HEATER CO., Inc., 2180 Cleora Avenue, St. Paul 4, Minnesota

Gentlemen:

We're interested in knowing more about National Heaters as noted below:

☐ Send additional material on the 1956 line.

☐ Have your representative call on us.

FIRM NAME:_____

ADDRESS:_____

BY:_____

POSITION:_____

NATIONAL HEATER CO., INC.
2180 Cleora Ave. St. Paul 4 Minn.

Circle 728 on Inquiry Card—Page 201

SILICAMIX . . . a new, superior, gun-shot CUPOLA PATCH

BUCKEYE SILICAMIX is a new development that provides a superior gun-shot mix for patching gray iron cupolas. Its uses provide the same qualities and results from this gun-shot material that have been so popular with the well known Buckeye Silica Firestone. Buckeye Silicamix is actually small pellets of this firestone, coated with clay—a special refractory fire clay. When applied under pressure with water, Buckeye Silicamix sticks tighter to the cupola walls, keeping costly "drop" to a minimum.

Try SILICAMIX on your cupola patching job . . . . . .

A Buckeye refractory engineer will bring you free samples for inspection and trial. See for yourself how its faster "buckshot" action adds up to more economical cupola operation.

SILICA CHEMICALS, INC.

Subsidiary of The Cleveland Quarries Co.

AMHERST, OHIO

Circle 729 on Inquiry Card—Page 201

K&R

Core Wire Straighteners GIVE YOU BIG SAVINGS!

K&R Straighteners are saving foundries substantial sums monthly! Many of the larger foundries employ multiple installations of K&R Straighteners. These machines re-straighten core wire to a usable condition – over and over again – as long as it remains ductile. There are two machine sizes: DX-5 for wire 1/8" to 3/8" dia. and F-5 for wire 3/16" to 5/8" dia. Bulletin 58B contains all the facts. Send for your copy today.

Kane & Roach

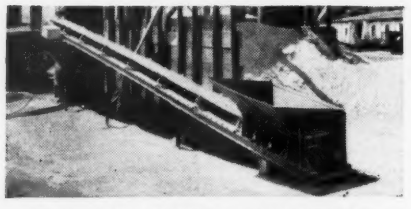
INCORPORATED

SYRACUSE, NEW YORK • ESTABLISHED 1887

Circle 730 on Inquiry Card—Page 201

If you think Barber-Greene makes only BIG conveyors...

you haven't heard of the...



375 TRANSFER CONVEYOR

- ★ lengths from 8'
- ★ widths 18", 24" and 30"
- ★ handles almost any bulk material

NEW FOLDER

. . . shows how you can figure your own horsepower and belt width in a minute.

see your B-G distributor or write

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

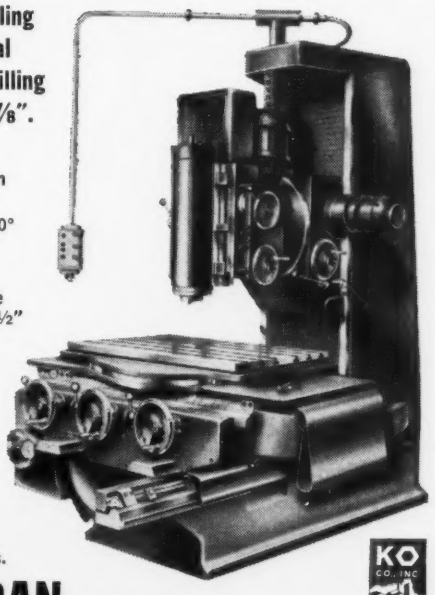
Circle 731 on Inquiry Card—Page 201

You'd need several machines to do all the different jobs possible on one

BOKOE No. 3 Universal Miller

For non-ferrous, cast iron and alloy steel tooling, patterns and production to close tolerances.

Use it for radial drilling in addition to vertical milling, universal milling and boring up to 11⅞".



- Column swivels 180° in either direction
- Milling head swivels 90° in either direction
- 37½" throat
- Distance between table and spindle head 0-37½"
- Rotary table handles bulky work up to 8'2"
- Weight 7½ tons

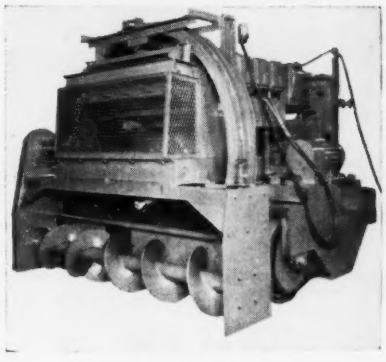
Smaller models, too.
Write for complete details.

KURT ORBAN company, inc.
38 Exchange Place, Jersey City 3, N. J.

T. M. REG

Circle 732 on Inquiry Card—Page 201

RINGLIFT SAND CONDITIONER



MODEL B34 RINGLIFT

Mixes, adds water, lifts all sand from floor, screens, magnetically separates, aerates. Cools hot sand. Cuts swath to 104", turns in 63" radius, Straddles 24" high x 70" windrows. Capacity to one ton per minute. Three foundry-proved sizes.

STATES ENGINEERING CORPORATION
922 W. Berry Street
Ft. Wayne, Indiana

Circle 733 on Inquiry Card—Page 201

FOUNDRY

EDWIN S. CARMAN, INC.

LEE ROAD AT MAYFIELD
CLEVELAND 18, OHIO

A COMPLETE FOUNDRY SERVICE

MECHANIZATION

Circle 734 on Inquiry Card—Page 201

Problems with Castings?

"GATES AND RISERS FOR CASTINGS"

by Pat Dwyer, formerly, Engineering Editor FOUNDRY magazine

- Recognized sourcebook of information on how to eliminate casting defects.
- Covers virtually all problems that arise in design and use of gates and risers for gray iron, steel, malleable, aluminum and brass-bronze castings.
- Simply written, easy to read text with detailed "how-to-do-it" drawings. This 3rd edition contains 31 chapters, 384 pages, 247 illustrations and is fully cross-indexed.
- Handy source of information which will pay for itself many times in the months and years ahead. Thousands of copies are already doing daily service in every type of foundry.

We invite you to examine "Gates and Risers" free for 10 days and decide for yourself how valuable it can be to you. At the end of that time, send us your check for $6.00, plus a few cents postage—or return the book without obligation. To get your copy just fill in and return the coupon below.

BOOK DEPARTMENT
Penton Publishing Co.
Penton Building
Cleveland 13, Ohio

Please send me a copy of "Gates and Risers for Castings" to examine FREE for 10 days.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Now . . .
INDUCTO
Controlled Melting Power Offers Higher Profit Margins

Maximum efficiency of the new INDUCTO control panel combines with the welded rigidity of the induction furnace to give you the most efficient and most economical metal melting equipment on the market today.

LOOK AT THESE IMPORTANT FEATURES:

- NEW FURNACE DESIGN . . . Rigid, welded construction increases lining life.
- NEW COMPACT CONTROL . . . Maximum efficiency in minimum space.
- WATER COOLED LEADS . . . Introduced through furnace trunion . . . area of least movement. Pits eliminated. Shorter leads offer minimum power losses.
- SELECTOR SWITCHES . . . Heavy-duty, water-cooled. Change furnaces in seconds. Mounted in lower part of control panel.
- LOWER INSTALLATION COST . . . No pits . . . less bus bar . . . ready-to-use control . . . you'll be in production immediately at far less cost.

Write today for Bulletin 60 giving complete details.

INDUCTOTHERM CORPORATION
412 Illinois Avenue • Delanco, N. J.

Circle 735 on Inquiry Card—Page 201

HIGH SILICA QUARTZITE PEBBLES

★ ★ ★

R. W. SIDLEY, INC.

THOMPSON, OHIO TEL. 2701

Circle 736 on Inquiry Card—Page 201

COST REDUCTION PROGRAMS

★*Organization* ★*Wage Incentives*
★*Methods Improvement* ★*Budgetary Controls*
★*Job Evaluation* ★*Diversification*

WALLEY & ASSOCIATES
SURVEYS • INSTALLATIONS • TRAINING
25 SEMINARY AVE., DAYTON 3, OHIO

Circle 737 on Inquiry Card—Page 201

EMPIRE
"THAT GOOD"
FOUNDRY COKE

DEBARDELEBEN COAL CORPORATION
2201 First Ave., North • Birmingham 3, Ala.
Phone: ALpine 1-9135

Circle 738 on Inquiry Card—Page 201

Master Power
HARD CHROMED • PORTABLE PNEUMATIC TOOLS

DO MORE WORK AT LESS COST
because they deliver more power per cubic foot of air consumed, are light in weight for easier maneuverability and they retain their new tool power longer.

ARE PREFERRED BY OPERATORS
because they are lighter in weight, better balanced and designed to reduce shock and be free from vibration.

IF YOUR PROBLEM INCLUDES
chipping, ramming, grinding, buffing, sanding or wire brushing, *write us today for full particulars.*

THE MASTER PNEUMATIC TOOL COMPANY, INC.
ORWELL, OHIO • U. S. A.
SALES • SERVICE • STOCK • COAST TO COAST

Circle 739 on Inquiry Card—Page 201

WHAT DO YOU NEED IN A COST METHOD

The simplest and most complete method of costing ever prepared for nonferrous foundries is found in

BASIC COST PRINCIPLES FOR NON-FERROUS FOUNDRIES

(Non-Ferrous Founders' Society Publication)

Up-to-the-minute guide for costing in both small and large foundries. Prepared by practical foundrymen, based on 10 years of research and experience of the industry under Government Pricing Regulations.

Price $5.00 Postpaid

THE PENTON PUBLISHING COMPANY
Book Department
1213 West 3rd St. Cleveland 13, Ohio

SAWING COSTS DRIVING YOU CRAZY?

Nonferrous metal-cutting band-saw blades really take a beating in average foundry service. Foundry management takes a beating, too, when sawing costs keep mounting because those saw blades don't deliver consistent, low-cost operation. To insure maximum sawing production and minimum down-time, simply call a HINCKLEY representative. Give him the responsibility of keeping those saw-blades sharp, of adjusting the teeth, checking the pitch, and keeping life in blades otherwise headed for the scrap pile. He will save you money, save your blades, and save your temper. Write today, and ask about the HINCKLEY SAW SHARPENING & REPAIR SERVICE.

HINCKLEY INDUSTRIES

P.O. Box 1100 Brunswick, Ohio

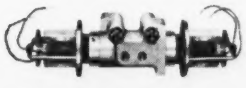
Circle 740 on Inquiry Card—Page 201

FOR AUTOMATIC CIRCUIT-CONTROL AIRMATIC VALVES

To meet the increasing demand for fully automatic or semi-automatic operations . . . eliminate the need for manual control. Airmatic Valves perform efficiently . . . maintain greater operating speeds. What's more, they are simple and compact in design—assure best arrangement.

A complete line of 2-way, 3-way and 4-way valves available for high-pressure or low-pressure installations.

Three-Way Valve



Solenoid Valves

Cylinders

Write today for complete details about Airmatic Products

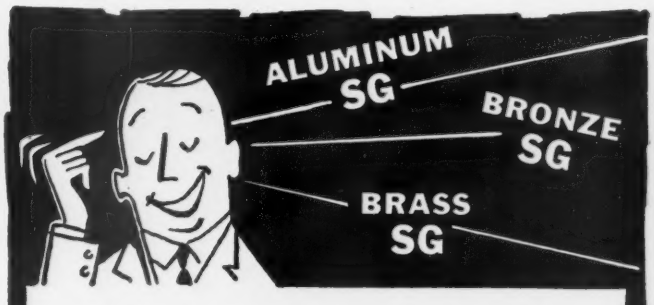
Attractive O. E. M. and Quantity Discounts

Delivery from Stock —Immediate

AIRMATIC VALVE INC.

7317 Associate St. Cleveland, Ohio

Circle 741 on Inquiry Card—Page 201



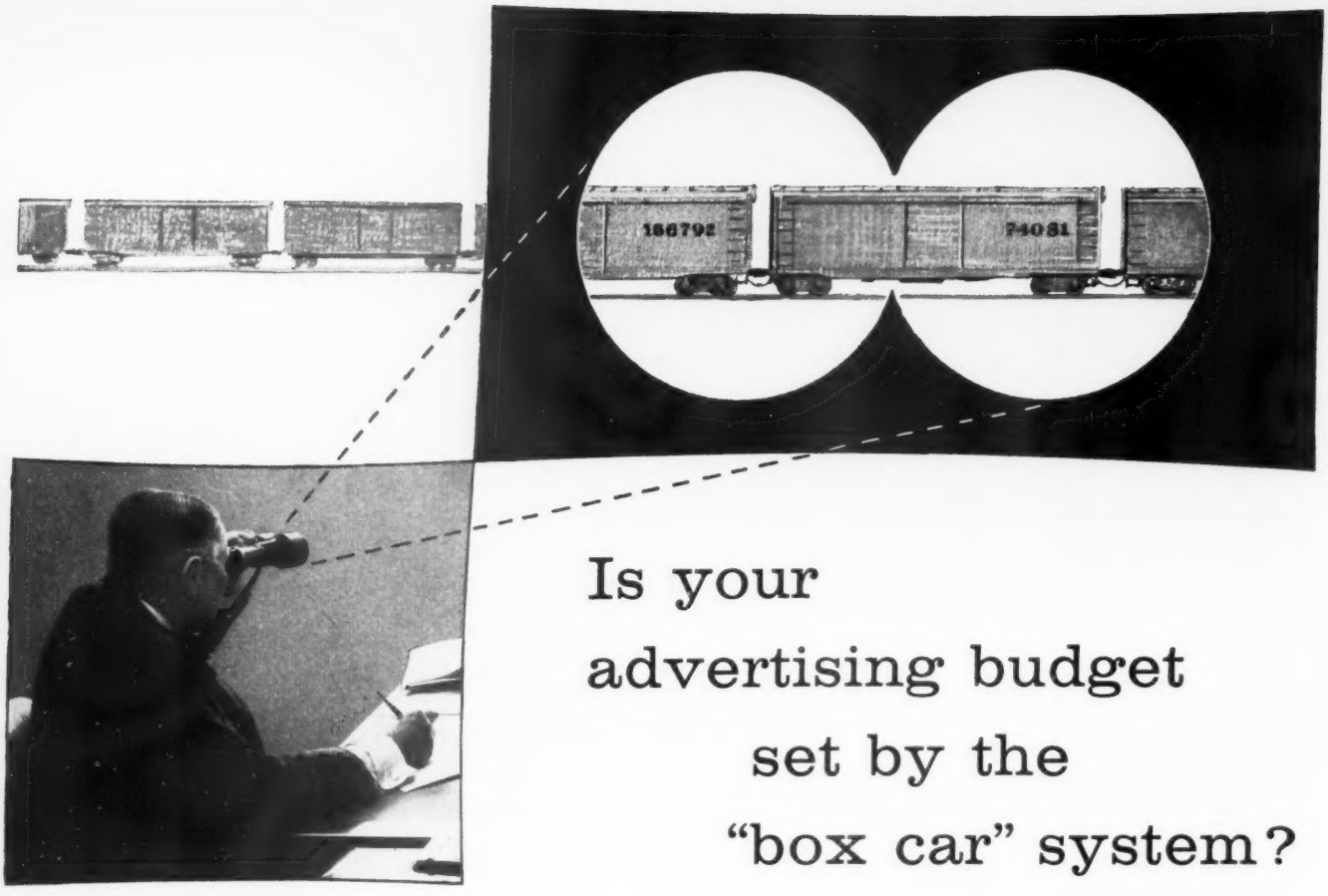
When You Think of ALUMINUM BRASS & BRONZE Think of Sonken Galamba

The initials "S-G" on aluminum, brass or bronze ingot means uniform quality that has been produced to meet the most rigid chemical and physical specifications. Whether it's for permanent mold, sand or die cast, you can be confident with "S-G" ingot.

SONKEN GALAMBA CORPORATION

Riverview at 2nd Street • Kansas City 18, Kansas

Circle 742 on Inquiry Card—Page 201



Is your advertising budget set by the "box car" system?

Figures in an advertising budget may be impressively precise and detailed, but still be as unrealistic as if they were picked from passing box cars. Such a budget is good enough only if you haven't decided just what you want to accomplish in selling.

If, however, your company has a specific marketing plan, if you have set your sales objectives product by product and market by market, then you have the foundation for an advertising budget which represents *planned sales effort*, not merely anticipated expenditures.

When your advertising people know exactly what you plan to sell, where you plan to sell it, and how much you plan to sell, they can begin to fit advertising into the marketing program. They can select from the many forms of advertising those which are best fitted for specific tasks, determine how each one should be used and to what extent it should be used.

In short, they can give you an advertising budget which reflects *the sales job you want done.*

Industrial advertising is an integral part of the marketing process—and you are not getting full value for your advertising dollar unless your advertising men are kept fully informed on your marketing plans.

National Industrial Advertisers Association, Inc.

271 Madison Avenue, New York 16, New York

An organization of over 4000 members engaged in the advertising and marketing of industrial products, with local chapters in ALBANY, BALTIMORE, BOSTON, BUFFALO, CHICAGO, CLEVELAND, COLUMBUS, DALLAS-FORT WORTH, DENVER, DETROIT, HAMILTON, ONT., HARTFORD, HOUSTON, INDIANAPOLIS, LOS ANGELES, MILWAUKEE, MINNEAPOLIS-ST. PAUL, MONTREAL, QUE., NEWARK, NEW YORK, PHILADELPHIA, PITTSBURGH, PORTLAND, ROCHESTER, ROCKFORD, ST. LOUIS, SAN FRANCISCO, TORONTO, ONT., YOUNGSTOWN.

CLASSIFIED ADVERTISING

Help Wanted

FOUNDRY MANAGER

Outstanding opportunity and challenge with long established New England Gray Iron Jobbing Foundry. We are looking for an exceptional man with a record of real accomplishment who is presently employed but looking for a challenging opportunity.

Must be thoroughly familiar with all phases of FOUNDRY operations, capable of managing and expanding our operations.

Our man must be a real leader who can demonstrate his ability to handle all Foundry responsibilities from purchasing to sales.

Reply giving complete details of qualifications, experience and compensation.

Information will be regarded as most confidential.

BOX 217, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY SHIFT FOREMAN

Position available in ferrous industry located in SOUTHERN CALIFORNIA. For man experienced in supervising employees engaged in ramming, pouring and shakeout of large iron castings.

Send resume giving complete job history, description of duties and salary needs to:

BOX 160, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

WANTED

Process Engineer covering metallurgical and inspection functions in a Steel Foundry specializing in producing low alloy and carbon steel castings.
Position covers technical control of metal making, sand control, plus testing and inspection functions.
Applicant must have good metallurgical background, coupled with sufficient experience in a steel foundry to qualify.

BOX 200, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

HELP WANTED

Steel Foundry for large Eastern Manufacturer desires young but experienced foundryman to act as liaison between foundry supervision and machine shops, and to assist in the operation and control of all phases of low Carbon and Alloy Steel foundry. This is a good opportunity with a well established company. In reply send resume, state age, experience and salary desired.

BOX 194, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

CLEANING ROOM FOREMAN

By Foundry making steel castings from 20# to 7500# of Carbon Steel and various alloys with production capacity of approximately 400 tons monthly. Foreman will be responsible for activities of approximately 60 employees. Plant located in Western Pennsylvania. This is a permanent position with a well established company. In reply state age, complete experience and name past employers, and salary expect. Address: Box 173, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT

Old established gray iron job foundry seeks thoroughly experienced man under 55 years in vigorous health and versed in heavy pit and slinger operations. Up to 25 ton castings. Must know metal analysis, rigging and estimating. Unusual opportunity, Chicago area. Write fully. Address: Box 184, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

COREROOM SUPERINTENDENT

BY WESTERN MICHIGAN GRAY IRON FOUNDRY. MUST BE FULLY QUALIFIED TO TAKE COMPLETE CHARGE OF ALL COREROOM OPERATIONS. SALARY OPEN. WRITE FULLY GIVING DETAILS OF JOB HISTORY, EXPERIENCE.

BOX 213, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

WANTED

Maintenance foreman for semi-mechanized foundry. Must be capable of assuming complete charge of department, and setting up a preventative maintenance program. Only man familiar with foundry maintenance need apply. Location: Illinois. Total Employment: 300.

BOX 179, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

ALUMINUM PERMANENT MOLD DEPARTMENT MANAGER

Need a man to manage the growing Aluminum Permanent Mold Department of a well established jobbing foundry in the Midwest. Must be able to design molds and be responsible for production of castings.

Box 219, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

NONFERROUS METALLURGIST

Or foundry engineer wanted to improve present aluminum and bronze sand casting and permanent mold practices and develop and introduce new processes. Address: Box 185, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

TIME STUDY AND QUALITY CONTROL ENGINEER

Prefer between the ages of 25 through 35. Knowledge of sand laboratory and metallurgy desired but not required. Permanent job in ductile iron foundry in Southeast. Send snap shot and full resume with first letter. Address: Box 191, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

EXPERIENCED STEEL FOUNDRY METALLURGIST

Wanted for shop producing carbon, low alloy, and high alloy steel castings. Excellent opportunity. Location: Northeast section of the United States. In reply, please send resume of education background and experience, also state salary required. Address: Box 147, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

DIRECTOR OF RESEARCH AND DEVELOPMENT

LEADING MIDWEST MANUFACTURER OF FOUNDRY EQUIPMENT HAS OPENING FOR AN EXPERIENCED DEVELOPMENT ENGINEER—WELL VERSED IN FOUNDRY METHODS. THE MAN WE ARE SEEKING IS NOT ONLY CAPABLE OF HEADING UP A DEVELOPMENT DEPARTMENT BUT IS AN EXPERIENCED DESIGNER OF HEAVY MACHINERY.

HE MUST BE THOROUGHLY FAMILIAR WITH ALL TYPES OF MOLDING AND CORE-MAKING EQUIPMENT PLUS MATERIAL HANDLING METHODS. IF YOUR EXPERIENCE AND BACKGROUND MEET THESE QUALIFICATIONS, AND YOU ARE CAPABLE OF EARNING $15,000 to $20,000 A YEAR, SEND COMPLETE CONFIDENTIAL RESUME TO:

BOX 190, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

ASSISTANT FOUNDRY SUPERINTENDENT

Want modern, control-minded Assistant Superintendent for Midwest Malleable Foundry producing mechanized and semi-production jobbing castings. Must think ahead and participate in modernization program while improving quality and reducing costs. Real opportunity and challenge at adequate salary and bonus. Reply giving personal data and salary requirements.

BOX 210, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

INDUSTRIAL ENGINEER

Wonderful opportunity for graduate engineer with foundry experience to assist modernization and cost reduction program in cast iron foundry. Send resume in confidence to:

WILLIAM I. PENTIN
PARKERSBURG RIG & REEL COMPANY
P.O. BOX 1160
PARKERSBURG, WEST VIRGINIA

MANAGER

Used foundry equipment division of prominent machinery company. To direct sales and advertising. Top salary with unlimited opportunity for advancement. Give complete resume in first letter. Replies confidential. Location Eastern Pennsylvania.
Mail replies to:

BOX 216, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

METALLURGISTS

Company engaged in basic process and pyrometallurgy requires several men for production, development and quality control who have some experience in one or more of the following: smelting and refining, steelmaking, or electric furnace operation. Excellent opportunities for qualified men. Hospitalization, insurance and pension plan provided by Company. Plants located midwest, north and south. All replies held strictly confidential. Submit detailed resume. Address: Box 201, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

METALLURGIST

Technically trained with malleable experience for well established progressive, jobbing and semi-production foundry in Milwaukee employing 150 men. Capable of supervising batch type air furnace melting, annealing and laboratories. Submit application including personal data, resume of qualifications and experience, references and salary expected. (Our employees know of this ad.) Address: Box 162, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

CLASSIFIED ADVERTISING

Help Wanted

MOLDING FOREMAN

Immediate opening in Northeastern Carbon and Low Alloy Steel Casting Foundry for competent man to assume full charge of all molding operations. This is a permanent, salaried position offering an excellent opportunity. Submit resume including education, personal history and work experience. All replies will be treated confidentially. Address:

BOX 212, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

METALLURGIST

With experience in foundry to take charge of laboratory and foundry control work. Knowledge of stainless steels desirable but not essential.

BOX 182, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

DESIGNERS-DRAFTSMEN-ENGINEERS

Experienced in foundry layouts and equipment. Send experience record, personal data, recent photo and references prior to personal interview.

BOX 209, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY FOREMAN

Foundry located near Pittsburgh making electric furnace castings of Carbon and Alloy Steel up to 8000 pounds is in need of fully experienced foundry foreman to supervise approximately forty molders. Applicant must be capable of deciding gating and heading procedures. Excellent opportunity for advancement for qualified man. Please forward resume of experience and education, starting salary requirements. Address: Box 207, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

BRASS FOUNDRY SUPERINTENDENT

Must have working knowledge of brass metallurgy, at least 10 years of permanent mold, die cast or sand foundry experience, under 50, salary open. Chicago area. Address: Box 188, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

NONFERROUS FOUNDRY

Needs superintendent to improve operations so that pressure tight bronze castings and aircraft quality aluminum castings are consistently and economically produced. Attractive opportunity in Northern Ohio. Address: Box 167, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

METALLURGIST

Midwest company operating large jobbing iron foundry specializing in alloy irons including Ductile wants man for metal and sand control. Ground floor opportunity with sound growing company. Prefer man with foundry background. Address: Box 159, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SCHEDULING AND PRODUCTION CLERK

Prefer between the ages of 25 through 35. Other duties include purchasing, inventories, reports, etc. Permanent job in ductile iron foundry in Southeast. Send snap shot and full resume with first letter. Address: Box 192, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOREMAN

Experienced cleaning room foreman. Production gray iron foundry making small castings. Address: Box 152, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Help Wanted

WANTED

Chicago steel foundry interested in aggressive men, age 30 to 45, with pattern background and experienced in developing molding and core practice. Must be able to work with other people. Future limited only by ability.

BOX 215, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

METALLURGIST

Metallurgist for Midwest Malleable Iron Foundry, three to seven years' experience, preferably in ferrous foundry operations. Heat treating or annealing experience helpful. Adequate salary depending upon education and experience.

BOX 211, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY FOREMAN

For Southeastern ductile iron, brass and aluminum foundry. Must have served time as a molder. Prefer between the ages of 25 through 40. Excellent opportunity. Send snap shot and full resume. Address: Box 193, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MOLDING FOREMAN

For steel foundry. Must know heading and gating for miscellaneous steel castings and be able to instruct trainees. Address: ELECTRO-CAST STEEL FOUNDRY CO., 4701 W. 15TH PLACE, CICERO 50, ILL.

Positions Wanted

CLEANING AND FINISHING DEPT. SUPERINTENDENT

TWENTY YEARS' PRACTICAL KNOWLEDGE IN ALL THE PROCESSES RELATIVE TO THE FINISHING OF CASTINGS FROM THE LOW CARBONS TO HIGH ALLOYS, STAINLESS AND CAST ARMOR. EXCELLENT RECORD OF EMPLOYEE RELATIONS. CAPABLE, AGGRESSIVE AND WILLING TO ASSUME RESPONSIBILITY. ADDRESS: BOX 203, FOUNDRY, PENTON BLDG., CLEVELAND 13, OHIO.

PATTERN SHOP SUPERVISOR

Age: mid 30's, married. Seven years' experience handling pattern shops in supervisory capacity. Responsible for all phases of pattern shop operations and production foundry practices. Address: Box 218, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANUFACTURERS' REPRESENTATIVE

College graduate with metallurgy background, calling on foundries in New York State, selling chills and chaplets, wishes to add allied line. Best references. If interested, Address: Box 208, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

REPRESENTATIVE AVAILABLE

Established sales representative experienced in the manufacture and design of steel castings with clientele of good customers desires steel casting connection for sales in the Cleveland, Ohio area. Address: Box 155, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

GRAY IRON FOUNDRYMAN

Available, thorough and practical, green and dry sand molding, coremaking, melting, costs, customer contacts, consulting and advisory work. Good handler of men, along in years. Plenty of know-how. Address: Box 206, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT

Twenty-six years' experience producing quality castings in plain and alloy gray iron from ½ lb. to 15 tons. Have been foreman, trouble shooter, foundry consultant, metallurgist and superintendent. Have the know-how to produce with minimum costs. Age 52, married. Will relocate. Address: Box 205, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR GENERAL FOREMAN

Thorough knowledge of all phases of nonferrous metals. Practical man, 36 years' experience, molder, foreman, superintendent, well versed all departments. Available immediately. Address: Box 214, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Representatives Wanted

FOUNDRY SUPPLY SALESMEN

Fastest growing supply house in Southeast needs two more salesmen. All National name brand supplies for complete foundry needs. All replies held strictly confidential.

BOX 202, FOUNDRY
PENTON BLDG., CLEVELAND 13, OHIO

SALES REPRESENTATIVE

To handle steatite and electrical porcelain. Also, special ceramic insulators and small refractories. Must be calling on electrical appliance and heater trade. Also, radio, television and electronics. Open territory—Indiana, Missouri, Wisconsin, New York, New Jersey, Eastern, Pennsylvania, Maryland, Virginia.

BOX 189, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

LEADING FOUNDRY SUPPLY COMPANY

Distributing supplies, binders, facings and equipment, has need for a man with foundry sales experience to cover Virginia, North and South Carolina and Baltimore. Excellent opportunity for an aggressive, personable man. Address: Box 187, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SALES REPRESENTATIVES

Michigan, Illinois and Indiana. Successful foundry supply sales experience essential. Profitable, frequent repeat additions to your present lines. Attractive commission. Replies confidentially treated. Write resume of experience and present lines. Address: Box 195, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

DESIRABLE TERRITORIES

Open for representatives calling on foundry and basic processing industries, in position to handle pneumatic vibration line on commission basis. Address: Box 199, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Representative Available

REPRESENTATIVE AVAILABLE

Manufacturer of foundry item desires accompanying sales line. Ten years' national distribution. All or part of United States considered. Address: Box 220, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Foundry Consultant

ELECTRIC FURNACE CONSULTANT BASIC AND ACID PRACTICE

Supervisor on electric furnaces for 35 years. Thorough knowledge of:

1. All kinds of plain carbon and alloy steel.
2. Analysis control.
3. High standard of physical properties.
4. Low Cost with high productivity.

EUGENE H. WEAK 2933 HIGHWAY AVE.,
HIGHLAND, IND. PHONE: TEMPLE 8-1244

Open Capacity

OPEN CAPACITY

Gray Iron, Cope and Drag Patterns also Squeezers.

PHARISBURG FOUNDRY CO.
MARYSVILLE, OHIO
RFD #1 PHONE 21142

PRODUCT WANTED

By manufacturer having well equipped machine shop and nonferrous foundry. Product can be either new or improvement on well-established item. Phone or write Mr. Hausman for appointment to discuss possibilities. Address: BRONZE BEARINGS, INC., 340 NORTH AVE., EAST, CRANFORD, N. J. CR 6-0600.

CLASSIFIED ADVERTISING

Employment Service

FOUNDRY PERSONNEL SPECIALISTS

National Placement and Procurement of

GENERAL AND PLANT MANAGERS, PLANT SUPERINTENDENTS, FOREMEN—ALL DEPARTMENTS, METALLURGISTS, ENGINEERS, CONTROLLERS, ACCOUNTANTS, SALESMEN, SALES MANAGERS, PERSONNEL DIRECTORS, PURCHASING AGENTS.

Confidential Inquiries Invited
From Employers and Qualified Applicants.

For Fast Competent Assistance Contact

DRAKE PERSONNEL, INC. **HARRISON 7-8600**
JOHN COPE, DIRECTOR **220 SOUTH STATE ST., CHICAGO, ILL.**

Opportunity

PERMANENT MOLD METHOD AVAILABLE

THE WAGNER PERMANENT MOLD CO., 2910 Empire Ave., Burbank, California, has developed a Permanent Mold Method for ferrous and non-ferrous metals and invites inquiries from any country regarding this method and process.

Wanted-To-Buy

WANTED TO BUY

1—Tablast, 9' Plain Table, w/Elevator. Must be late model and in good condition.

PITTSBURGH METAL PROCESSING CO., INC.
1850 CHAPMAN STREET
PITTSBURGH 15, PENNSYLVANIA

WANTED TO BUY

Two good, used, cylindrical, covered LADLES, 1500 to 1800 lb. capacity.

THE BONNOT COMPANY
722 MULBERRY ROAD S.E.
CANTON, OHIO

WANTED TO BUY

Tractor Sandslinger, Size 11'—13' with magnetic separator.
Core Ovens—Battery of two, transrack, oil fired recirculating air heating system. Minimum size 14' wide x 15' long x 7' high. Give description, age and conditions.

THE EASTERN FOUNDRY CO.
BOYERTOWN, PA.

WANT TO BUY

Interested in buying a small to medium-size foundry producing Niresist, Nihard and similar heat, corrosion and abrasion resistant castings. Please submit complete details in first letter in strict confidence. Address: Box 204, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MIXERS WANTED

Used Simpson Intensive Sand Mixers. State size, condition and lowest cash price or immediate acceptance. Address: Box 578, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PUSHER DOGS

We need 150 pcs. M-78 Pusher Dogs, #1 for Link Belt #456 Conveyor Chain. Address: **INTEGRITY SUPPLY, 305 NORTH FRONT ST., COLUMBUS 15, OHIO.**

Foundries For Sale

FOR SALE
OR LEASE
Land and Buildings
of
THREE RIVERS CASTING CO.
Three Rivers, Michigan
BARGAIN AT $55,000.00

Brick and concrete block and steel construction, concrete floors; 28,000 square feet. Served by New York Central RR and Michigan Central RR. Lloyd-Thomas Appraisal $175,000.00 plus land. Oil fired boiler; overhead heating units; sprinkler. With or without foundry equipment. Immediate possession. Complete details upon request.

BOX 177, FOUNDRY
PENTON BLDG. **CLEVELAND 13, OHIO**

NONFERROUS FOUNDRY

Will sell or give lease with option to buy, now operating in Western Pennsylvania. 4,000 sq. ft. steel and concrete block building on half acre level industrial location. Require $20,000 cash. Owner giving time to other activities. Address: Box 186, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SMALL FOUNDRY FOR SALE

Well-equipped foundry in Eastern Pennsylvania. Has overhead crane, cleaning equipment. Plenty of adjacent land. On railroad. Address: Box 183, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

For Sale

FOUNDRY MACHINERY AND EQUIPMENT
BOUGHT AND SOLD

One piece or a complete foundry

Prompt Action

Muellers—Rollovers—

Squeezers—Slingers

Flasks—Blowers—Grinders

Wheelabrators etc.

HOMAN MACHINERY COMPANY
824 REEDY ST.
CINCINNATI 2, OHIO
MAIN 1-4634

For Sale

FOR SALE

MOLDING MACHINES
1—Tabor 22" Power Jolt, Rollover, Draw, Portable, 22" x 32" Table.
1—Herman, Jolt, Rollover Draw, 6000#, 40" x 60" table.
2—International, Jolt, Rollover Draw, 24" x 10G, Stationary.
2—No. 275 Osborn jolt squeezers. Stationary.

CORE OVENS
1—Coleman Recirculating 3 section with 5 drawers per section. Gas fired.
1—Coleman Recirculating 4 section with 5 drawers per section. Gas fired.
1—Porbeck Recirculating, gas fired, double end, thru-drawer type.

BLOWERS FOR CUPOLAS AND FURNACES
1—Connersville Rotary Blower, 3500 CFM.
2—#7½ Roots rotary blowers—27 x 81—14000 CFM.
2—Connersville Rotary 14" x 27" HD, 2750 CFM at 5# press.
Maxon-Premix Blowers for Gas ¼ to 1 HP.
2—2 HP 20 oz. Spencer Turbine Blowers.
1—Spencer Turbine Blower, 2700 CFM, 27 oz., 30 HP, 3/60/220-440 V.

METAL MELTING EQUIPMENT
1—1000# open flame brass melting furnace, gas fired.
1—Hausfeld Stationary Brass, oil or gas burner, 200# cap.
1—Hausfeld Tilting crucible, gas, 250# A1, Cap.
1—Hausfeld 2000# aluminum capacity furnace, barrel type, open flame, oil fired.

MISCELLANEOUS
3—Jib cranes, 16' swinging beam, 2000# cap.
1—Ingersoll-Rand, 4000#, air hoist.
1—Sly Tumbler 24" x 40".
1—International SB-11 core blower.
2—Pangborn cloth screen collectors, 2 HP.
1—Stoney crane type shakeout.
1—NDP Royer sand separator.
1—#16 Roto-clone unit complete.

Complete stock of rebuilt mill and dust exhaust blowers.

CLIFTON MACHINERY COMPANY
1023 W. SIXTH ST. **CINCINNATI 3, OHIO**

FOR SALE

TURBO BLOWERS WITH MOTORS

CFM	PRESS.	MAKE	CFM	PRESS.	MAKE
8375	20oz.	Spencer	380	16oz.	No. Am.
6000	32oz.	Ing.-Rand	340	20oz.	A-B
4700	32oz.	Ing.-Rand	320	12oz.	Spencer
2500	7oz.	Sturt.	9000	6"SP	Northern
1300	16oz.	Spencer	3420	8"SP	N.Y.
800	13oz.	Buffalo	2700	⅝"SP	Ilg
400	12oz.	Buffalo	2500	½"SP	American
450	7oz.	Spencer	1100	4½"SP	Bayley
400	16oz.	No. Am.	2344	2"SP	Clarage

THE MOTOR REPAIR & MFG. CO.
1552 HAMILTON AVE.
CLEVELAND 14, OHIO

FOR SALE

One #6 Whiting Cupola purchased new in 1942 complete with Whiting Skip Hoist Charger. Available for inspection.

THE FOREST CITY FOUNDRIES CO.
CLEVELAND 13, OHIO

CLASSIFIED ADVERTISING

For Sale

FOR SALE

JOLT ROLLOVER MOLDING MACHINES

#918 Johnston & Jennings—44" x 54"; 18" draw; no pit required	$1250.00
#2047-4 Osborn, 18" x 24"; stationary; 1942	275.00
#601 Osborn; 750 lb. cap.; 30" flask...	350.00
#602 Osborn; 750 lb. cap; 36" flask...	450.00
#605 Osborn; 750 lb. cap; 54" flask...	650.00
Tabor 30" x 40"; extends to 69"; 12" draw, shockless type; 1000 lb cap. ..	950.00

JOLT STRIP MOLDING MACHINE

#559 Osborn—25 x 30; 1200 lb. cap....	550.00

JOLT SQUEEZE STRIP MOLDING MACHINES

Nichols—Type B; 14" cyl. 14" x 36"...	250.00
#211 SPO	550.00
#213 SPO—19 x 26; 4½" jolt cyl.; 13" sq.	750.00
#2114 SPO—14 x 24; 11" sq. cyl.	650.00
#2136 SPO—13" sq. cyl.	750.00
#720 U Osborn—31 x 44; 11" sq. cyl..	550.00
International—PKL- 14 x 5½"	650.00

JOLT SQUEEZERS

Nicholls—Type D	250.00
Osborn—#275 J 16 x 20; 10" sq. cyl....	275.00
Osborn—#276 J	350.00

PUSH OFF MACHINES

Champion—Model LLA-45; 45 x 26" used with sandslinger	350.00
International; Model LP-Portable Pin Lift; 30 x 40 used with sandslinger..	350.00

CORE BLOWERS—CORE ROLLOVERS

#193 Osborn—for med. cores	650.00
#94 Osborn—for large cores	750.00
Osborn Hand Rollovers—Model 42.....	100.00

MATERIAL HANDLING EQUIPMENT

Model HA Hough Payloader	1000.00
Clark Fork Lift Truck—6000 lb	1000.00
Elwell Parker Fork Lift Truck—4000 lb	1000.00
Mercury Fork Lift Truck—2000 lb. Elec.	1000.00
Lewis-Shepard Platform Lift Trucks....	150.00

FURNACES

Stroman—2000 lb. Tilting Hydraulic....	1500.00
Fisher—2000# Aluminum	2000.00

CORE OVENS

Dielectric—Model 900A and 1800A. Set up in your shop in operating condition. Less than ½ new price	12,000.00

MISCELLANEOUS FOUNDRY EQUIPMENT

U. S. 7½ H.P. 3 speed grinder; 28" wheel	450.00
Model S B & P Screenerator	225.00
Royer Screenerator	250.00
Climax Wire Straightener	400.00
Model AA American Sandcutter	750.00

FOR THE BEST DEAL CALL
BALCHER MACHINERY COMPANY
695 E. 152nd STREET
CLEVELAND 10, OHIO
TELEPHONE: GLENVILLE 1-2474

FOR SALE

1—Simpson Mixer, #2, 20 HP motor.
Miscellaneous: Screens, Pulverizers, Grinders, Tyler Rotap Screens, etc.
Wanted: Your Idle Machinery.

OUR 39th YEAR.

CONSOLIDATED PRODUCTS CO., INC.
66 BLOOMFIELD STREET
HOBOKEN, NEW JERSEY
HO 3-4425 N. Y. TEL. BA. 7-0600

FOR SALE

Slightly used Allis-Chalmers 5 KW Foundromatic Dielectric Core Dryer. Address: EMPIRE PATTERN & FOUNDRY COMPANY, P.O. BOX 1647, TULSA, OKLAHOMA. B. R. KINCADE.

For Sale

FOR SALE

We have the best selection of HARD CHROME REBUILT PNEUMATIC TOOLS WE HAVE EVER HAD.

Ingersoll-Rand Size 24 Floor Rammers
Ingersoll-Rand Size 14 Bench Rammers
Cleco Bench Rammers
Chipping Hammers—All types
Core Breakers and Grinders

Our prices are about half the cost of new tools.

All tools sold by us are guaranteed and can be returned if found not satisfactory.

Repair and Rebuilding Service on all Pneumatic Tools

CENTRAL PNEUMATIC SERVICE COMPANY
512 LINDEN AVE., DAYTON, OHIO
TELEPHONE: MADISON 2701

SAND BLAST EQUIPMENT

Bought	Sold	Traded
48 x 48 Wheelabrator		$5000.00
42 x 48 Wheelabrator		2500.00
36 x 42 Wheelabrator		3000.00
27 x 36 Wheelabrator, rubber or steel belt		3000.00
15" Continuous Wheelabrator		2000.00
36" Continuous Wheelabrator		6000.00
9' Pangborn L.F. Table		4000.00
6' Pangborn Air Table		975.00
1½ Cu. Ft. Pangborn Air Barrel		200.00
ES-421 Pangborn Shell Machine		800.00
14GK2 Pangborn Rocker Barrel		2500.00
#2 American Table		1500.00
Tumbling Barrels, Horizontal or Vertical		125.00
Vapor Blast, Cabinet		600.00

Hand Cabinets, Dust Collectors, Pressure Tanks, Rooms. All Types and Sizes.

DIAMOND SAND-BLAST, INC.
5654 W. JEFFERSON
DETROIT 9, MICHIGAN
PHONE: VI-36750

FOR SALE

Wheelabrator 48/42 skip loader and dust collector
Wheelabrator 20/27 rubber belt, collector if desired
Pangborn 1½ cu. ft. Roto Blast (air type)
Pangborn, American and Ruemelin Dust Collectors
Pangborn and Ruemelin hand blast cabinets
2—Pangborn dust collectors, #223CK, 3000 CFM, 7½ HP motor, 3 years old, used 2 years. Guaranteed in every way. One-half of new price.
We buy and sell heat treat and sand blast equipment.
All above items and many more in our shop.

F. D. RICHARDSON & CO.
12925 AUBURN AVENUE
DETROIT 23, MICHIGAN
PHONE: BROADWAY 3-9124

FOR SALE

MOTORS—GENERATORS
TRANSFORMERS
Unused — Rebuilt
WORLD'S LARGEST INVENTORY
ELECTRIC EQUIPMENT COMPANY
Phone Station Collect GLenwood 6783
P.O. Box 51—Rochester 1, New York

FOR SALE

Air compressor, Worthington YC-2, 2 cylinder 2 stage, complete with 200 HP motor, 440 volts, 514 RPM, 3 phase, 60 cycle, excellent condition. 1—48 x 92 American Wheelabrator Tumblast with skip type bucket loader. Complete with exhaust fan, 4 motors, etc. 1—6000 Herman independent turnover and pattern drawing device, complete with 45 cu. ft. capacity air receiver. 12—core ovens, complete with compressor, blowers, Partlow recording instruments and Wheelco Flameotrols. Address: Box 198, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

For Sale

FOR SALE

One Shaw Bridge, double girder, fish belly, 50 ft. span, 230 V. D.C. The unit is old but in good condition.

One Morgan 10 to 15 ton Hoist & Trolley. This unit can be used as a 10 ton hoist, or with additional shives as a 15 ton unit. D.C. Motors, Westinghouse 230 V. No cable or hook. Excellent condition and not too old.

One P & H Hoist & Trolley. D.C. Motors, 230 V. No cable or hook. Excellent condition.

Two cabs and controls for above units. Good Condition.

Either of these hoists can be used to work with the Shaw bridge, with minor modifications.

One 3 Ton Chisholm Moore Electric Hoist, 220 V. A.C. Heavy Duty. Floor controls and adjustable motorized bridge. Floor controls, underslung. Late mfg.

HOMAN MACHINERY CO.
824 REEDY ST.
CINCINNATI 2, OHIO
MAIN 1-4634

COMPLETE CUPOLA UNIT
PRACTICALLY NEW—1955

48" Whiting #6 Cupola with 3 ton Crane and Charging bucket, complete with Wilbraham Green rotary pressure blower, size #7, with Westinghouse gear drive motor 125 HP, grids and control panel—2 standard Whiting transfer cars 48" and 60", also electric towing car and Fairbanks 3000# track type charging scale.

EASTERN SCRAP & SALVAGE CORPORATION
65 MUIRHEAD AVE., TRENTON, N. J.
PHONE OWEN 5-6351

FOR SALE

FOUNDRY MELTING EQUIPMENT
Whiting No. 7 Cupola
Whiting No. 8 Cupola
Whiting 3 ton Charging Crane
Charging Buckets
Elevated Structural Steel Charging Platform and other Foundry Accessories
Priced for Quick Sale for Prompt Removal

ACORN IRON & SUPPLY CO.
915 N. DELAWARE AVE.
PHILADELPHIA 23, PA.
WALNUT 2-7070

FURNACES FOR SALE

Ten used heat treating furnaces and two 7-ton gantry cranes. Good condition, priced to sell. Address: BAER STEEL PRODUCTS, INC., BOX 1428, BOISE, IDAHO.

FOR SALE

Completely overhauled Roots-Connersville Blower, 3200 CFM; maximum capacity. Will sell for $750.00. Motor not included. Also offer #6 Branford Shakeout for $100.00 and a #8 for $150.00. All prices stated are F.O.B. Alpena, Michigan. Address: THUNDER BAY MFG. CORP., P.O. BOX 317, ALPENA, MICHIGAN.

For Sale

FOR SALE

1 two ton electric arc furnace, complete, less transformer and panel board. Cheap and quick removal.

BOX 165, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOR SALE

One 69/45" Model AM American Sandcutter. Original purchase price was $5,000. Used only 3 years. A bargain at $1,500. Has Spiral Reel. Ideal piece of equipment if it fits into your operation.

EXCELSIOR FOUNDRY COMPANY
"B" ST. & IOWA AVENUE
BELLEVILLE, ILL.

FOR SALE

1—37 x 42 American Wheelabrator Tumblast with pit loader. Now in operation but will be available September 1, 1956.

GOLDENS FOUNDRY & MACHINE CO.
P.O. BOX 96
COLUMBUS, GEORGIA

FOR SALE

Good Used Steel Flasks
30 Popular Sizes
From 9½" x 15" to 17½" x 21"
Send for list and prices

NEWTON FOUNDRY COMPANY
NEWTON, IOWA

For Sale

FOR SALE

One—6' (plain) American Wheelabrator Tablast complete with controls, 440 volts, 60 cycle, 3 phase.
One—Osborn Jolt Squeeze Molding Machine 276-J, Serial No. 10433-W, 26" x 20" table, 22" throat, 16" x 22" squeeze plate complete with air valves.

THE ST. MARYS FOUNDRY COMPANY
ST. MARYS, OHIO

FOR SALE

Beardsley & Piper Nite Gang. Very little used, excellent condition. Reason for selling—change in operation.

NATIONAL RUBBER MACHINERY CO.
FOUNDRY DIVISION
COLUMBIANA, OHIO

FOR SALE

#24 Gardner Horizontal Disc Grinder, 53" Dia. table; ball bearing 30 HP 3/60/220 motor in base; wheel dresser; 8 new sets grind discs; $1250.00.

Core Rod:—¼"; 5/16"; ⅜"; 7/16"; Other sizes available.

SEABOARD STEEL CO., INC.
NEW HAVEN, CONN.

FOR SALE

EBG-4 "Lancaster" counter-current Rapid Batch mixer complete with hopper, 10 HP gear motor, mixing tools and 4' metal stand. All equipment in good condition and priced to sell. Address: MODERN CRETE MFG. CO. OF DETROIT, 2031-NATIONAL BANK BLDG., DETROIT 26, MICHIGAN.

FOR SALE

1—#85 Wheelabrator Dust Collector. Complete, in very good condition. Address: HUTCHINSON FOUNDRY PRODUCTS, 4131 ALBY STREET, ALTON, ILLINOIS.

For Sale

FOR SALE

1—48 x 48 Heavy Duty American Wheelabrator Tumblast capable of handling castings up to and including 250 lbs. including complete electrical equipment for 440 volt, 60 cycle, 3 phase current. Serial #A-25079.
1—American Tumblast Loader complete with electrical equipment for 440 volt, 60 cycle, 3 phase current.

BOX 197, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOR SALE

International Core Blower, Serial #71902; Type SB-13; capacity approximately 60# core; approximate size of core box 2-ft. square.

BOX 196, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOR SALE

Hydrogen brazing furnace, Hoskins continuous, pipe SK 200.18, 25 KW, Serial No. 23717, chamber 6.5" wide x 5" high x 36" long, excellent condition, completely overhauled, full price includes all equipment, transformer, Leeds & Northrup controls, hydrogen purifier and drier.

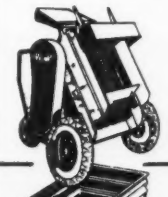
E. M. MC NICHOLS
928 W. MC NICHOLS STREET
DETROIT 3, MICHIGAN

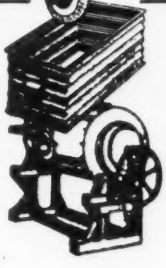
FURNACES FOR SALE

Two Hausfeld tilting, gas or oil, Style 675, 800# brass capacity. Complete with blower: $550.00 each. 1 Reda melting furnace, good condition: $1200.00. Address: PORTSMOUTH FOUNDRY CO., 2707 JOHNSON ST., PORTSMOUTH, VIRGINIA.

FOR SALE

Cheap, never used No. 2½ iron cupola with blower and motor, 5 HP. For details call or write: DEMPSEY & KOLIE FOUNDRY, 6311 EAST 31st STREET, KANSAS CITY 28, MISSOURI. WA 3-3934.





EUCLID FOUNDRY & MACHINE EQUIPMENT CO.

14919 SARANAC ROAD CLEVELAND 10, OHIO

ANNEALING FURNACE

Loftus Engineering, Pusher type, gas fired, recirculating complete with all controls overall dimensions: 45' lg. x 10' wide x 12' high

MOLDING MACHINES

Jolt Squeeze Strip
2—#724 Osborn Pinlift, 24" squeeze cyl., 10" draw
2—#24-54D Nicholls Framelift 24" squeeze cyl., 8" draw

Jolt Frame Strip
4—Model 16JS Nichols, 12" draw, 7000# cap.

AMERICAN SAND CUTTERS

1—Model AM size 74 x 50, 15 H.P. travel 220/440
1—Model AA size 4'8", 10 H.P. travel 220/440

ASK FOR OUR COMPLETE LISTING!!

TUMBLING MILL:

60" x 72" Ransohoff tumbling type wet cleaning mill, Serial No. 6318, drive 15 HP. bucket loader 5 HP 3/60/220

MAGNESIUM CLEANING CABINETS:

7—Whirlpool Duplex, 800 CFM, 100" wide x 65" deep x 90" high. Buffalo exhausters—7½ HP., 220/440

FOR SALE NOW: In Bellville, Ohio, 10 miles south of Mansfield a complete Gray Iron Foundry with No. 7 Whiting cupola, 18,000 sq. ft., with railroad siding.

WE BUY AND SELL ONE PIECE OF EQUIPMENT OR COMPLETE FOUNDRIES

Telephone . . . Glenville 1-1222

GUARANTEED FOUNDRY EQUIPMENT

AAA MACHINERY & EQUIPMENT CO.

over 1000 satisfied customers

WORLD'S LARGEST INVENTORY OF GUARANTEED FOUNDRY EQUIPMENT

AIR COMPRESSORS

1—CHICAGO-PNEUMATIC Size 7½ x 6 Single Stage horizontal, 20 HP Motor, Starter etc, 220/440 volts.
4—GARDNER-DENVER Model ADR, 4" stroke, 15 HP Motor & electrical 220/-440/3/60 cycles 125 PSI pressure, w/-storage tanks. New in 1950's.
1—SULLIVAN Type WN-3 size 20" x 12" x 14", 1220 CFM, 250 HP. AC Motor.

AIR HOISTS

1—INGERSOLL-RAND, Size C Air Hoist, 2000 lb.
75—INGERSOLL RAND RC-5, 500 lbs.
10—INGERSOLL RAND LC-7, 700 lbs.
3—INGERSOLL RAND Size "AN" 500 lbs.
6—INGERSOLL RAND Size "BN" 1000.
1—INGERSOLL-RAND Size "D", 4,000 lbs.
1—INGERSOLL-RAND Size "D6", 6000.
1—INGERSOLL-RAND Size "E", 10,000.
15—DETROIT, 1 and 2 ton cap.
15—APPLETON air hose reels, swivel base, 50', and 75 capacities.

ELECTRIC HOISTS

1—P & H 5-ton capacity Electric Hoist, complete with power trolley, pendant controls, 220/440/3/60.
1—Comet 1000 lbs. capacity.
1—SHAW Box 1000 lbs. capacity.
2—SHAW BOX 6000 lbs. cap. Lo-Head room, AC 3/60/220/440 volts.
1—DETROIT 10,000 lbs. cap. Model LHR, AC, 3/60/220/440 volts.

BUCKET ELEVATORS

1—LINK BELT 30' Centers, 10" x 7" Buckets, w/Motor and Drive.
1—LINK BELT 35' Centers, 12" x 7" Buckets, w/Motor and Drive.
2—LINK BELT 40' Centers, 14" x 7" Buckets, w/Motor and Drive.
1—LINK BELT 50' Centers, 16" x 8" Buckets, w/Motor and Drive.

CUT-OFF MACHINES

1—DEWALT model ME2 cut-off saw, 10 HP motor, 24" Carboloy blades.
1—TABOR model C10AF, Abrasive Disc, 16" Wheel, 10 H.P. Motor.
1—GROB Band Saw, Type OS-36, open end, 36" throat. MD.
3—TESSMER Model "H" & "I" Sprue Cutters.

CORE WIRE AND ROD STRAIGHTENERS

1—AMERICAN Type E Pneumatic Rod Straightener and Shear, 1¼" capacity.
2—CLIMAX #2, 2A, 1/16" to ¼".
1—CLIMAX #3, ¼" to ⅜", Length 10".

CORE GR'INDERS

2—MILWAUKEE Rotary Type, Model 70-12, 70" Dia. Table. Very Late.
1—STONEY core grinder, 16" dia. wheel, 48" travel, 5 HP AC motor.

CORE BLOWERS

1—REDFORD No. 1 Bench type Core Blower.
2—CHAMPIONS CB 10, Max. Core 10 lbs.
2—CHAMPIONS CB 400, Max. Core 300.
1—DEMMLER No. 55 Max. Core 6 lbs.
1—DEMMLER No. 1, Max. Core 10 lbs.
2—DEMMLER No. 2K, Max. Core 20 lbs.
2—DEMMLER No. 2E, Max. Core 20 lbs.
2—DEMMLER No. 2, Max, Core 20 lbs.
2—DEMMLER No. 3, Max. Core 35 lbs.
2—DEMMLER No. 3K, Max. Core 35 lbs.
2—DEMMLER No. 3E, Max. Core 35 lbs.
1—DEMMLER No. 4, Max. Core 100 lbs.
1—DEMMLER No. 4E, Max. Core .. lbs.
2—INTERNATIONALS No. SB, 11 Max. Core 15 lbs.
2—INTERNATIONALS No. SB 13, Max. Core 30 lbs.
2—OSBORN No. 92, Max. Core 35 lbs.
2—OSBORN No. 192, Max. Core 50 lbs.
2—OSBORN No. 193, Max. Core 75 lbs.
6—MILWAUKEE TACCONE Model A-3, Max. Core, 4 lbs.

CORE OVENS

1—COLEMAN Model #1 Jr. Gas Fired Portable Core Oven, drawer type, 5 drawers, 3 burners, with controls.
1—INDUCTION Heating Dialectric, Model M-800A, 600 lbs. per Hr. New.
1—INDUSTRIAL "Revolving Carriers" Continuous, Trays 18" x 80", Gas Fired.
1—YOUNG BROS. 2-Comp. 10 Drawers, Overall 9' x 12' x 8', Gas Fired.
1—MAEHLER SINGLE COMPARTMENT I.D. 96" L x 80" W x 84" High, Gas Fired Recirculating, L & N Controls.
2—DIETERT #500 LAB DRYING TYPE.

CUPOLAS BLOWERS & ACCESSORIES

1—WHITING No. 6 Cupola, with Loader, Controller, Motor and Blower.
1—WHITING No. 3½ Cupola, with Loader, and Blower. NEW 1953.
1—ROOTS CONNERSVILLE, Size 20 x 44, 7000 CFM, Type HD, 50 HP Motor.
4—LINDBERG Centrifugal Blowers 2100 CFM, with 15 HP Motors.
1—BASIC REFRACTORIES BRI Gun, Model 110. For cupola lining.
5—WHITING 42" Dia. Charging Buckets.
1—CUPOLA Bondactor. For lining.
1—I & R Single Stage FS-367, 100 HP, 9400 CFM.

DUST COLLECTORS & ROTO-CLONES

1—AMERICAN AIR FILTER No. 20, Type N Rotoclone Dust Collector, Arrangement C, with sludge ejector.
1—AMERICAN Air Filter No. 12, Type W, arrangement "C," with Sludge Ejector.
1—AMERICAN Air Filter No. 14, Type W, arrangement "C," with Sludge Ejector.
1—AMERICAN Air Filter No. 27, Type W, arrangement "C," with Sludge Ejector.
2—AMERICAN Air Filter Type N, Size 10 with Bench. For Grinding.
1—AMERICAN Air Filter Type N, Size 24, 24,000 CFM, 75 HP Motor.

ELECTRIC ARC MELTING

2—AJAX #500 Nose Tilt Furnaces, 3000 cycle. Used with Induction MG Set
1—AJAX #300 Nose Tilt Furnaces, 3000 cycle. Used with Induction MG Set.
2—DETROIT Rockers, Indirect Arc, Type AA, 750-1000 lbs. capacity. Complete with 200 KVA Transformers, Control Panels, Automatic Electrode Holders.
2—DETROIT Rockers, Indirect Arc, Type AA, 1000-1500 lbs. capacity. Complete with 358 KVA Transformers. Control Panels, Automatic Electrode Holders.

GAS & OIL FIRED FURNACES

2—LINDBERG-FISHER Model MNP, Size 300, electric tilt, with motor and blower.
1—LINDBERG-FISHER Model MNP, Size 400, electric tilt, with motor and blower.
6—LINDBERG FISHER Model MNP, Size 1700, Electric Tilt, Motor & Blower.
3—LINDBERG FISHER Model MNP, Size 2400, Electric Tilt, Motor & Blower.
2—LINDBERG FISHER, Type BB1, Size 25, Hand Tilt, with Motor & Blower.
12—LINDBERG FISHER, Model SSH, Size 550, Stationary, Motor & Blower.
6—LINDBERG FISHER, Model SSH, Size 150, Stationary, Motor & Blower.
3—LINDBERG FISHER, Model SSH, Size 60, Stationary, Motor & Blower.
10—CAMPBELL HAUSFIELD, Stationary, Size 125 to 250, Motor & Blower.
2—CAMPBELL HAUSFIELD, Model 1PNT, Size 2000 lbs., Electric Tilt, with Motor & Blower.

GRINDERS—SWING FRAME

1—MARSHKE, 12" x 2", 3 HP.
1—MARSHKE, 20" x 10", 10 H.P.
2—FOX, No. 6, 24" x 10", 15 HP.
1—MARSHKE 24" x 10", 15 HP motor.

GRINDERS—SNAGGING

3—U. S. ELECTRICAL, No. 65, 24" x 3" x 12" Wheel, 15 HP, 4-Speeds.
3—U. S. ELECTRICAL, No. 65, 30" x 4" x 12" Wheel, 20 HP, 4-Speeds.
2—U. S. ELECTRICAL, No. 64, 14" x 3" Wheel, 7½ HP, 4-Speeds.
1—HAMMOND, Model WR-1, 24" x 3" x 12" Wheel, 10 HP.
2—SAFETY RITES, No. 174, 24" x 3" x 12", 10 HP.

GRINDERS—DISC

1—GARDNER Vertical Spindle Dry Grinder, 36" dia., 10 HP Motor. NEVER USED.
1—BEASLEY #372 Vertical Spindle Dry Grinder, 53" dia., 20 HP Motor. New 1952.
1—QUEEN CITY, Model 100 Double End, wheel size 20" x 2" x 2", with 10 HP Motor.
1—U. S. ELECTRIC, No. 80, Double End, Wheel size 16" x 3", with 7½ HP Motor.

HEAT TREAT FURNACE

2—LINDBERG, Model 4860 GH, Gas Fired 48" x 60", Recirculating, with L & N Controls to 1250° F.
1—LOFTUS ENGINEERING CORP. Annealing, Walking Beam Type, Gas Fired. 1600°, Recirculating, 10' x 12' x 40'.
1—AJAX MFG. Electric, ID 54' Long, 46" Wide, 36" High, 800°. Single Phase.

LADLES

4—WHITING 5-ton capacity Teapot Ladles.
12—MODERN pouring devices, Models F-9 and FA-9, with tapered covered ladles. 400 to 800 lbs. capacity.
3—WHITING Cylindrical, 275 lbs. 19" x 26".
2—MODERN Cylindrical, 1500# 29" x 30".
1—MODERN mixing, 44" x 44", on wheels, 4000 lbs.
2—STEVENS Cylindrical, 2450 lbs. 29½" x 41¼".
9—WHITING Lip Pour, 1200 lbs., 23" x 23".
6—MODERN Lip Pour, 1600 lbs. 24" x 24".
2—WHITING Lip Pour, 2000 lbs. 29" x 29".
3—WHITING Lip Pour, 4000 lbs., 32" x 32".
3—WHITING Lip Pour, 5000 lbs., 34" x 34".
2—WHITING Lip Pour, 7000 lbs., 41" x 41".
1—WHITING Lip Pour, 8000 lbs., 44" x 48".
2—WHITING Lip Pour, 10 ton 62" x 62"
1—WHITING teapot, 4000 lbs., 32" x 32".
1—WHITING Lip Pour, 40 ton capacity.

MOLDING MACHINES JOLT SQUEEZERS

2—MILWAUKEE No. 104, 10" cyl., portable.
2—MILWAUKEE No. 123, 12" cyl., stationary.
6—MILWAUKEE No. 181, 18" squeeze cyl. 24" x 36" table.
8—OSBORN No. 275 JW, Straddle Type, 10" Cyl., Portable.
16—OSBORN No. 275J, 10" Cyl., Portable.
3—OSBORN No. 276J, 12" Cyl., Portable.
6—OSBORN No. 210 PJ, Swing Back Head, 10" Cyl., Stationary.
6—OSBORN No. 212 PJ, Swing Back Head, 12" Cyl., Stationary.
1—CHAMPION No. JS-10-P, 10" Cyl., Swing Back Head, Portable.
20—SPO No. 110J, 10" Cyl., Portable.
6—TABOR 10" cyl. portable and stationary models.

JOLT ROLLOVER PATTERN DRAW

1—DAVENPORT model 24SA, 24" x 30" table. 12" draw, 1200 lbs. capacity
1—DAVENPORT No. 28 SA, 29" x 40" table. 1500 lbs. cap., 12" draw.
1—DAVENPORT No. 34 SA, 34" x 48" table. 2500 lbs. cap., 15" draw.
1—DAVENPORT No. 28R, 34" x 48" Table, 12" Draw.
1—DAVENPORT No. 40-SA, 42" x 50" Table, 3000 lbs. Jolt, 18" Draw.
1—HERMAN #6000 Series, 42" x 78" Table, 6000 lbs. Jolt Cap., 20" Draw.
1—HERMAN #1500 Series, Table 26" x 30", Jolt 1500 lbs.

WRITE FOR OUR COMPLETELY NEW CATALOG OF USED FOUNDRY EQUIPMENT.

AAA MACHINERY & EQUIPMENT CO.

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AAA MACHINERY & EQUIPMENT CO.

over 1000 satisfied customers

WORLD'S LARGEST INVENTORY OF GUARANTEED FOUNDRY EQUIPMENT

2—HERMAN Hi-Speed Jar, 1500 lb. series, 26" x 48" table.
1—HERMAN #750 Series, Table 20" x 30", 750 lbs. Jolt.
2—HERMAN #4000 series, 40" x 60" table, 13" jolt cyl.; 4000 lbs. cap.
2—HERMAN #10,000 series, 60" x 84" table, 10,000 lbs. cap. 20" jolt cyl.
6—INTERNATIONAL "R" Core Rollovers.
1—INTERNATIONAL "G" Size 20" x 8".
1—INTERNATIONAL "G" Size 24" x 10".
1—INTERNATIONAL "G" Size 30" x 12".
1—INTERNATIONAL RES. Size 15" x 8".
1—INTERNATIONAL Type "F," 31" x 54". Draw 16", Jolt Cap. 2500 lbs.
4—JOHNSTON & JENNINGS model 918, 44" x 54" table, 20" draw, 2000 lbs. cap.
1—JOHNSTON & JENNINGS 815-B table 30" x 40", draw 15", jolt 1500 lbs.
1—MILWAUKEE #167, Table 32" x 33", Draw 12", Jolt 1000 lbs., Sq. Cyl. 16".
1—MILWAUKEE 217 table 35" x 41", sq. cyl. 16", draw 12", jolt 1200 lbs.
1—MILWAUKEE Model 60B-3, 60" flask, 18" draw.
10—OSBORN No. 40 and 42, Hand Core Rollovers, 18" x 8" Draw.
1—OSBORN No. 342, Table 23" x 38", Draw 10", Jolt 1000 lbs.
1—OSBORN No. 442, Table 21" x 31", Draw 10", Jolt 600 lbs.
1—OSBORN No. 242W, Table 29" x 42", Draw 19", Jolt 1500 lbs.
2—OSBORN No. 405, Table 57" x 64", Draw 26", Jolt 3000 lbs.
6—OSBORN No. 601, 30" wide Flask, 10" Draw, 750 lbs. Jolt.
6—OSBORN No. 602, 36" Wide Flask, 10" Draw, 750 lbs. Jolt.
2—OSBORN No. 332, Flask Size 26" x 36", Draw 9", Sq. Cyl. 16", 1500 lbs. Jolt.
1—SPO No. 413D, Table 24" x 25", Draw 10", Jolt 600 lbs., Sq. Cyl. 13".
1—SPO model 506, portable, 24" x 30" table, 10" draw, 600 lbs. capacity.
3—TABOR, Size 30" x 40" Table, 12" Draw 1000 lbs. Jolt Cap. Stationary.
4—TABOR, Size 22" x 32", Draw 10", Jolt 600 lbs.

JOLT PIN LIFT

2—DAVENPORT model 24 AJS, 24" x 30" table, 8" draw, 1000 lbs. capacity.
1—DAVENPORT No. 40 AJS, Table 44" x 54", Jolt 4000 lbs., Draw 18".
2—MILWAUKEE Model 2542, 38" x 42" table, 12" draw, 3000 lbs., jolt cap.
2—OSBORN No. 559, Table 25" x 30", Draw 6", Jolt 1200 lbs.
1—OSBORN No. 563, Table 55" x 63", Draw 12", Jolt 7000 lbs.
1—SPO model 307, 24" x 30" table, 8" draw, 1000 lbs. capacity. Portable.

PIN LIFT

1—INTERNATIONAL Model LP 6, 8" draw, 750 lbs. cap.
1—INTERNATIONAL LP 10, 30" x 30" flask, 1000 lbs. cap.
2—MILWAUKEE No. 620 ND, 24" x 30" table, 2000 lbs. cap.

JOLT SQUEEZE PIN LIFT

1—INTERNATIONAL PKL, 12", Squeeze Cyl., 6" Draw.
1—MILWAUKEE No. 163, Table 15" x 24", Draw, 8", Jolt 1500 lbs., Squeeze Cyl. 16".
1—OSBORN 175J table 18" x 21", draw 5" sq. cyl. 10".
2—OSBORN No. 710J Table 17" x 21", Squeeze Cyl. 10".
1—SPO 2114, table 20" x 27", 4" draw, 600 lbs. jolt, 11" cyl.
1—SPO 2146, table 21" x 31", 6" draw, 14" cylinder, portable.
1—SPO 2136G, table 19" x 26", 6" draw, 13" cyl. portable.

JOLT (BUMPERS)

2—FEDERAL Bumpers, 24" x 36" table.
1—DAVENPORT, model AJS, 20" x 30" table, 1000 lbs. cap.
1—HERMAN, 40" x 60" Table, 13" Cyl. 6000 lbs. Jolt.
1—TABOR, Table 30" x 40", 2800# cap.

MATERIAL HANDLING EQUIPMENT

1—BLAW-KNOX ½ yard clamshell bucket, single line.
1—INGERSOLL RAND, Size MHU, Air Winch, 2000 lbs. Cap.
6—LEWIS SHEPPARD Platform Hand Lift Trucks (For Core Room).
1—LINK BELT car puller, #5 capstan.
1—HOUGH Model HA Payloader, hydraulic lift, 12 cu. ft. bucket.

CONVEYOR BELTING

1600'—HEWITT-ROBBINS 30" wide, 5 ply rubber covered. Used.
100'—HEWITT-ROBBINS 18" wide, 8 ply elevator. Never Used.
80'—LINK BELT Distributing Belt Conveyor, with (8) Molders Hoppers, with plows and gates, for Squeezer system.

CONVEYOR BELTS

1—JEFFREY Trough, 20" x 35' centers.
1—JEFFREY Trough, 24" x 75' centers.
1—JEFFREY Trough, 24" x 103' centers.
1—LINK BELT flat, 24" x 40' centers.

STEEL APRON CONVEYOR

1—LINK BELT 36" x 100' centers, motor and drive.
1—LINK BELT 30" wide by 128' Apron Type Sorting Conveyor complete w/motor & Drives. On 36" High Stands.

VIBRATING CONVEYOR

1—LINK BELT Model PA 36" x 40' Oscillating Conveyor, with 5 HP Motor. Used less than 6 months—LIKE NEW.
3—SIMPLICITY Model OA-10-A, 36" x 15'.

PORTABLE TROUGH CONVEYOR

1—FARQUHAR, 18" x 35'.

OSCILLATING CONVEYOR

1—LINK BELT 48" x 154'.

ROLLER CONVEYOR

800'—MATHEWS 22" Roller Conveyor, 2¼" Dia., 6" centers, 4" channel iron, complete with stands. LIKE NEW.
200'—MATHEWS 6" Roller Conveyor, 2½" dia., 3" centers, 4" channel iron. Heavy Duty.

CHAIN CONVEYOR

500' JARVIS No. 678, complete with drives.

UNDER CAR UNLOADER

1—FARQUHAR, 18" x 19'.

TRAMRAIL

3—LOUDEN MONORAIL SYSTEMS, "Super Track"
(1) 110' of 6" I-beam & two 20' bridges
(2) 140' of 6" I-beam & two 12' bridges
(3) 130' of 11" I-beam & two 30' bridges: All Complete.
1—AMERICAN TRAMRAIL system with (1) 1 ton 20' span underslung bridge, and 150' of 12" tramrail, with air reels.
4—AMERICAN TRAMRAIL 2 ton cap. 20' span underslung bridge cranes. Complete.
2—AMERICAN TRAMRAIL 4 ton cap. 20' span underslung bridge cranes. Chain gear travel, complete.

OVERHEAD CRANES

1—WHITING 5 ton Overhead Crane, 50' span, Cab Operated, AC.

MOLD DRYERS

1—PORBECK Mold Dryer, 42" wide, 8' long, oil fired, Serial No. 242.

MOLD CONVEYOR

1—WEBB 109 Cars, Car Tops 32" x 39".

SAND MULLERS

1—BEARDSLEY & PIPER No. 50 Speedmuller, with Loader and Dust Hood, 50 HP Motor.
1—LINK BELT 48" x 8' Paddle Type Sand Mixer.
1—BAKER PERKINS No. 16½, 30 HP
1—CLEARFIELD, #414 Batch, 4 Cu. Ft.
1—CLEARFIELD, #610 Batch, 6 Cu. Ft.
1—BEARDSLEY & PIPER No. 60 with loader, 75 HP motor.
1—SIMPSON, #1 Style B, Single Wheel, 400# Batch.
1—SIMPSON, #3 Style C, Enclosed Gears —3000#.
1—SIMPSON #2, Style UD, 1500 lbs. Batch. With Loader.
1—SIMPSON, #2, Style C, 1500 lbs., with Loader. Enclosed Gears.
1—DRAVO-DOYLE 6 Cubic Feet Capacity Wonder Model, portable, 5 HP 220-440
1—SIMPSON No. 1 Style B, 2 wheel, separate drive, with Aerator, 10 HP motor & Speed Reducer
1—SIMPSON Porto-Muller, 350 Lb Batch.
1—SIMPSON No. 1½, style UD, with loader. 700 lbs. batch.
1—SIMPSON No. 2, model H, 1000 lbs. cap. with loader.

SAND PREPARATORS

6—ROYER Sand Conditioning Units, consisting of:
(1) 1' x 5' Royer Shakeout
(1) Farquhar 18" x 30' Conveyor underneath Shakeout
(1) Royer Model NDS Sand Preparator
6—B & P Screenarators, Models—M & L.
1—PEKAY Aerator, Model 320-3. (For Sand System).
8—ROYERS, Models NDP-C-2, NC-4.
1—SIMPLICITY LP 2'x3', Portable, 3 HP.
1—NEWAYGO READY-SANDY. Model RSVM, shakeout, magnetic separation

SAND CUTTERS

1—AMERICAN Model AA 5'2" Cutting Blade
2—AMERICAN Model M, 79/60.
1—AMERICAN, Model M-Size 99/80.
1—AMERICAN, Model M-Size 89/70.
1—MOULDERS' Friend 60" brush.

SAND SLINGERS

2—JEFFREY Swivel type Flask Filler Booms.
1—B & P, 19" Tractor Type, 13' Arm.
1—B & P, 16" Tractor Type, 13' Arm, Magnetic Tower, 4' Ramming 4" Tip.
2—B & P, Model 16S-DB Stationary Type, 16" Head.
2—B & P Swing Type Slingers, 16" Head

SHAKEOUTS & SCREENS

1—SIMPLICITY 4' x 10' Model D, 16,000#.
1—HEWITT-ROBINS 36" x 78", Vibrex Screen, Style M-7.
1—LINK BELT 5' x 10' heavy duty.
1—SIMPLICITY 6' x 8' Model DE, 16,000#

TUMBLING BARRELS

2—SLY 42" x 72" Square, 10 HP, Gearhead with Built-in Brake. Timken Bearing.
2—SLY 36" x 84" Type C. 7½ HP. Gearhead Built-in Brake. Timken Bearing.
4—WHITING 48" x 72", 10 HP Gearhead, with Built-in Brake. Timken Bearing.

SAND BLAST EQUIP.

1—AMERICAN 86" diameter swing table with dust collector.
1—AMERICAN No. 3 tablast, 4-48" auxiliary tables.
1—AMERICAN No. 1 tablast 7-14" auxiliary tables.
1—AMERICAN 27" x 36" Tumblast with skip hoist, shot return & electrical.
1—AMERICAN 36" x 42" Tumblast with Skip Hoist, Shot return & electrical.
1—AMERICAN 42" x 48" Tumblast, with Skip Hoist. Shot return & electrical.
1—AMERICAN 48" x 48" tumblast, with loader. New belt, excellent.
1—HOLLINGSWORTH Model 44" x 48" Tumblast.
1—HYDRO-BLAST cabinet, 40 HP motor and pump.
1—PANGBORN Shot Blast Room 10' x 12' x 14', with Dust Collector, Elevator.
1—PANGBORN 9LG, 9' Table, 8-24' Tables.

TESTING EQUIPMENT

1—GENERAL ELECTRIC X-RAY, Industrial Type. Model KX10, 140 KW.

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GUARANTEED REBUILT EQUIPMENT

AIR COMPRESSORS
COMPLETE STOCK—BURY, PENNSYLVANIA, SULLIVAN, INGERSOLL-RAND —SEND YOUR REQUIREMENTS

BLOWERS
25—CENTRIFUGAL, 16 oz., 2 to 5 HP
10—GE, WILBRAHAM-GREEN, FISHER Positive Pressure and Cent. Cupola Blowers

CLEANING EQUIPMENT
1—AMERICAN WHEELABRATOR TUMBLAST 1945, 48" x 72", with Skip Loader, Vert. bucket conveyor, motors & controls

1—AMERICAN WHEELABRATOR TUMBLAST, 48" x 48" w/loader
1—AMERICAN WHEELABRATOR TUMBLAST, 42" x 48" w/loader
1—PANGBORN TABLAST, 8' Table
1—PANGBORN ROTOBLAST, #BVR-5
1—PANGBORN ROTOBLAST, #28, Type GK
1—PANGBORN BLAST CABINET, #EP-5
3—TANNEWITZ METAL CUTTING BANDSAWS, 30" and 36"
1—TABOR ABRASIVE CUT-OFF SAW, Model C-10-AF, 10 HP
1—CRESCENT METAL CUTTING BANDSAW, 30"
4—BURRING BENCHES, Magnesium cleaning, 9' L x 30" H x 30" W

CONVEYORS
1—LINK BELT, vibrating, double deck, 80' x 24", w/exhaust hood
1—LINK BELT, 21'6" x 24", with drive
1—LINK BELT, Car type mold, 114 cars, 403' track, car size 18" x 42"
1—JEFFREY, 3 compartment, ingot mold
4—SAND ELEVATORS, Various sizes
6—SAND BELTS, 10' ctrs. to 140' ctrs.
2500 FEET—FOUNDRY TYPE ROLLER CONVEYOR—ALL SIZES

CORE BLOWERS
4—DEMMLER #1
3—DEMMLER #2, vert. or horiz.
1—DEMMLER #3K
1—DEMMLER #55, late model
2—OSBORN #91, #92
2—CHAMPION, Model CB-12 & CB-400
1—INTERNATIONAL SB-13

CUPOLAS
2—WHITING #5 complete with Skip Charger and Blower
1—MORRIS #9, Skip charger, Blower, Mixing Ladle, Never Installed
1—SKIP CHARGER for #9 Cupola with scale and buckets

DUST COLLECTORS
4—ROTOCLONE, #12, Type N, wet type
1—ROTOCLONE, #16W
2—ROTOCLONE, Size 20D, Hopper type F

FLASKS
150 HINES AND FREEMAN ALUMINUM, Popoffs and Jackets

200 TRANSITE CORE PLATES, Various Sizes
SEND US YOUR REQUIREMENTS

FURNACES—DIRECT ARC MELTING
1—3,000#/hr. LECTROMELT
1—3 Ton/hr. LECTROMELT
1—6 Ton/hr. HEROULT
1—250#/hr. Single Phase

FURNACES—INDIRECT ARC
1—350#/hr. DETROIT, Complete
1—1,000#/hr. DETROIT, Complete
1—2,000#/hr. DETROIT, Complete

FURNACES—INDUCTION MELTING
2—333 KW, AJAX-TAMA-WYATT, 1500# Alum., 60 cycle
1—333 KW, AJAX M.G. Type with Furnaces, 960 cycle
1—175 KW, AJAX, 60 cycle, complete
1—50 KW, G.E. MG Set, 960 cycle
1—30 KW, LEPEL
1—20 KW, AJAX SPARK GAP, High Frequency
1—15 KW, TOCCO MG Set, 10,000 cycles
1—3 KW, AJAX, Lab type

SPECIAL OFFERING
NATIONAL ENGR. SAND HANDLING SYSTEM
2—SIMPSON #3 Mullers, 3 Overhead Hoppers, FAIRBANKS 3,000# Scale, 20 ft. Motorized pit Conveyor, ROTO-CLONE Dust Collector, STEDMAN PULVERIZER, BELT CONVEYOR 24" x 24', Wash Tank, All Motors, Drives and Controls.
HEWITT ROBINS COKE SYSTEM
1—42' Vibrating CONVEYOR, 2 VIBREX COKE SCREENS, 3 Storage Hoppers, FAIRBANKS SCALE
THESE UNITS SPECIALLY PRICED FOR IMMEDIATE REMOVAL—CAN BE SEEN ERECTED NOW!

FURNACES—GAS & OIL
1—FISHER MNP, Gas, Tilting, 1700# cap. Mag.
3—FISHER, Gas, Stationary, 4 Burner, 500# cap.
7—FISHER MNP, Oil, Tilting, with blowers, 500# cap. Alum.
7—FISHER MNP, Oil, with blowers, 1500# cap. Brass
5—FISHER, Oil, Stationary, model 125, type S, Brass
1—DEMPSEY, Reverberatory, 10,000#, 9' W x 14' L x 9' H, Oil
1—HAUSFELD, Gas, Stationary, 1000#
1—HAUSFELD, Oil, 600# Cap.
1—HAUSFELD, 100-125 Crucible, Gas
1—SKLENAR, Oil, 600# Cap.
1—STROMAN, Gas, Tilting, 1,000# cap. Alum., auto control, hyd. lift

MOLDING MACHINES
Jolt Rollovers
1—J & J #1020, 50" x 60", 20" draw
2—J & J #918
1—J & J #815, 30" x 40", 15" draw, 1200# jolt
1—J & J #612, 24" x 30", 12" draw
3—J & J #610, 24" x 30", 10" draw
1—INTERNATIONAL, Type G, 24" x 10"
1—HERMAN 10,000#, 48" x 109" table
2—HERMAN 1500#
1—HERMAN 750#, 30" x 36"
1—SPO #506, Portable
1—OSBORN #602
1—OSBORN #601, 30" x 24", 10" draw
2—OSBORN #405-86, with levelling carriage
1—OSBORN # 405, 3,000#, flask size 64" x 50", 18" draw
1—OSBORN #333
1—OSBORN #332
2—OSBORN #243, 27" x 40", 20" draw
2—OSBORN #242, Rockover draw, w/oil cylinder and operating valve
5—OSBORN #142, 15" x 20", hand draw
1—TABOR, 30" x 40" with air clamps
5—TABOR, 22" x 42", pattern draw, shockless, portable
1—TABOR, 22" x 32", with air clamps
2—TABOR, 14" x 16" Rockover

Bumpers
2—DAVENPORT, 30" x 30" table
1—DAVENPORT, 24" x 27" table

Jolt Strippers
2—J & L, 30" x 24" table, 600# cap.
2—SPO #305, 20" x 27" table, 750# cap.
1—HERMAN, 22" x 30" table, #4317
1—TABOR, 20" x 20" table, hand strip
1—MILWAUKEE #1536, 32" x 38"
1—INTERNATIONAL 1255 PKL

Jolt Squeeze Strippers
1—OSBORN #175, 21" x 18", portable
2—SPO #2136, 21" x 30", 800# cap. 13" cylinder
1—MILWAUKEE #165
2—MILWAUKEE #163

Jolt Squeezers
1—SPO #113J, Portable
8—SPO #110J, Portable
3—OSBORN #276-J, Cantilever
4—OSBORN #275-J, Portable
13—OSBORN #275PJ, Stationary
2—OSBORN #712PJ, Stationary
1—OSBORN #212PJ, 17" x 23", Stationary
4—INTERNATIONAL, #12 LJS

MULLERS AND MIXERS
1—SIMPSON #0, 3' Dia., 1½ to 1¾ cu. ft.
1—SIMPSON #1, 4' Dia., 4 cu. ft.
1—SIMPSON #2, 6' Dia., 14 cu. ft
1—SIMPSON #3, 8' Dia., 25 to 30 cu. ft.
1—B & P SPEEDMULLOR, #60, 5'2" Dia., 12 cu. ft.
1—B & P SPEEDMULLOR, #70, 6'4" Dia., 18 cu. ft.
1—B & P SPEEDMULLOR, #80, 6'6" Dia., 24 cu. ft.
1—CLEARFIELD, #920, 9' Dia., 25-30 cu. ft.
4—BAKER PERKINS, #4A

LADLES AND POURING DEVICES
MODERN, SWINDELL, WHITING, TREADWELL—All Types and Sizes—Ready for your Needs!

OVENS
1—COLEMAN, Elec., 5 drawers, 6' W x 7' H x 8' L
1—COLEMAN, Oil, one compartment, recirc., 60" W x 80" H x 14'6" L
2—ROSS, Gas, 2 compartment, recirc., rack type, 6½" x 14' x 7'
1—YOUNG BROS, elec., 3 compartment, Kiln type
3—GENRICH, elec., 3 drawer, preheating, auto-control, 9' H x 8' W x 6'7" L

SAND CONDITIONING
3—B & P SCREENERATORS Model L, M and S
5—ROYER, NB-2, 12" Belt
2—ROYER SAND BLENDERS, 12" & 16" belts
2—JEFFREY SANDITIONERS, PORTABLE

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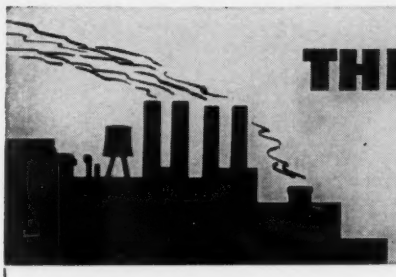

THE ACME *bargain page*

AIR COMPRESSORS
Ingersoll Rand Type 10, 800 CFM, 2 stage air compressor, 200 HP, 220 V motor. Rebuilt 1952.

BLOWERS
Ingersoll-Rand Type FS. Single Stage 4000 CFM @ 3.75 PSI, 100 HP, 220V G. E. Induction motor.
General Electric 7500 CFM, 20 oz., 89.6 Max. HP, 220V motor, Airway controls.
Ingersoll-Rand turbo compressor 10500 CFM @ 20 oz. 85 HP G. E. 220V 3500 CFM motor.

CORE BLOWERS
3—International SB 12.
4—International SB 13.
10—Osborn 193.
1—Osborn 2035-2.
1—Champion CB 400.
2—CB 10 Late Type.

CORE GRINDERS
4—Milwaukee 70-9.

CORE OVEN VERTICAL HORIZONTAL
1—Coleman, combination oil or gas fired 43 carriers 24″ x 90″—1 hour 12 min. to 4 hours 48 min. cycle.
1—Coleman, combination oil or gas fired 43—2 shelf carriers 30″ x 144″ long. 2 hour 12 min. to 7 hour 24 min. cycle. Present replacement cost over $90,000.

CORE PASTE OVENS
2—Coleman Gas Fired 28′-25″ x 42″ opening.

CRANES
1—Milwaukee 10 ton 40′ span, 22′ lift, 220 V. A.C.
2—Northern 5 ton 40′ span, 22′ lift, 220 V. A.C.
1—Whiting 5 ton 40′ span, 22′ lift, 220 V. A.C.

ELECTRIC MELTING FURNACES
Detroit Electric 1500#—Kuhlman 13200 volt transformer complete with controls.
Detroit Electric 350#—Kuhlman 13200 volt transformer and controls.

FURNACE TRANSFORMERS
We have Electric Furnace Transformers in stock from 800 KVA to 2500 KVA. Write us your needs.

GRINDERS
Horizontal Disc (Flat) Grinders:
Gardner #186, 30″ dia. disc. 10 HP, 220/440V, with dresser, wet or dry grinder.
Double End Disc:
1—U.S. 18″ wheels, 2 swing tables.

GRINDERS, SNAGGING
2—Hammond 10 WRI D. E. Snag. 20″ dia. wheels, 10 HP 220/440 v motors, variable speed drives.
1—3″ x 24″ U.S. #65, 20 HP 220/440V.

GRINDERS, SWING FRAME
2—3″ x 24″ x 12″ Fox #4, 15 HP.
1—3″ x 24″ x 12″ Marschke, 20 HP.
1—3″ x 24″ x 12″ U.S. 15 HP.

HOT METAL CARRIERS
3—1 ton D.C. Cab operated Cleveland, Monotractor Hot Metal Carriers.

MOLDING MACHINES
Jolt Squeezers:
5—Milwaukee 103-11 Staty. Jolt Squeezers, 13½″ x 20″ table.
7—Champion JS10P Portable Jolt Squeeze molding machine, 18″ x 21″ table.
10—Osborn 275J.

Jolt Squeeze Pin Lifts BIG
2—Milwaukee Jolt Squeeze Strippers, Model 163-50, 15″ x 24″ table 16″ X open end pattern size.
1—Milwaukee 126-3 Jolt Squeeze Pin Stripper, 27″ x 21″ table, 8″ draw. Portable.
2—#165 Milwaukees.

ROLLOVERS
1—Herman 4000# Series 30″ x 60″ table.
1—Herman 3000# Series 40″ x 84″ table, special slotted table.
1—Herman 1500# Series 20″ x 36″ table.
2—Herman 750# Series 20″ x 30″ table.
2—Herman 750# Series 20″ x 24″ table.
1—Davenport 24 SA Jolt Rollover Pattern Draw. 26″ x 42″ flask size, 12″ draw.
3—Spo Model 9032.
1—Milwaukee 217.
2—International Type G, Portable, 20″ x 8″ draw.
3—Tabor Portable Rollover 30″.
Johnson & Jennings 1020-44 x 44 max. Flask Size.

PIN LIFT PUSHOFFS
1—Champion Pin Pushoffs 28″ x 42″ table 10″ draw.

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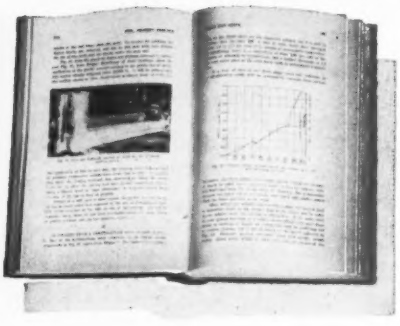

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ABOUT THE AUTHOR

The late John Howe Hall was associated with the production of steel castings for nearly 50 years. Mr. Hall received his bachelor's and master's degrees from Harvard University. He was employed by Bethlehem Steel Co. and Buffalo Crucible Castings Co. until 1906, when he joined Taylor-Wharton Iron & Steel Co. He remained there until 1937, when he became a consulting metallurgist. His previous major work was The Steel Foundry, *published in 1914, with a second edition in 1922.*

Mr. Hall was the author of many papers presented before the American Society for Testing Materials, the American Foundrymen's Society, the American Institute of Mining and Metallurgical Engineers and the American Society of Mechanical Engineers. In 1924, he received the first Whiting Medal awarded by the AFS.

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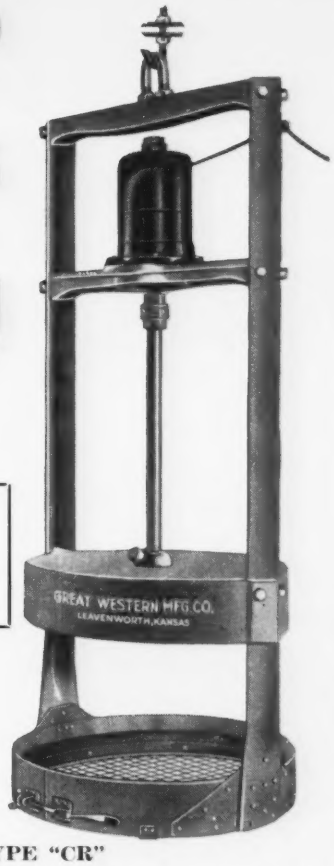

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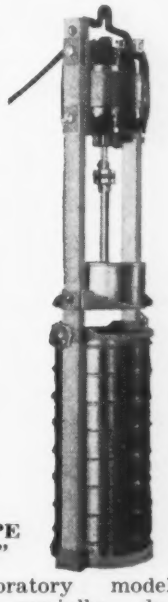

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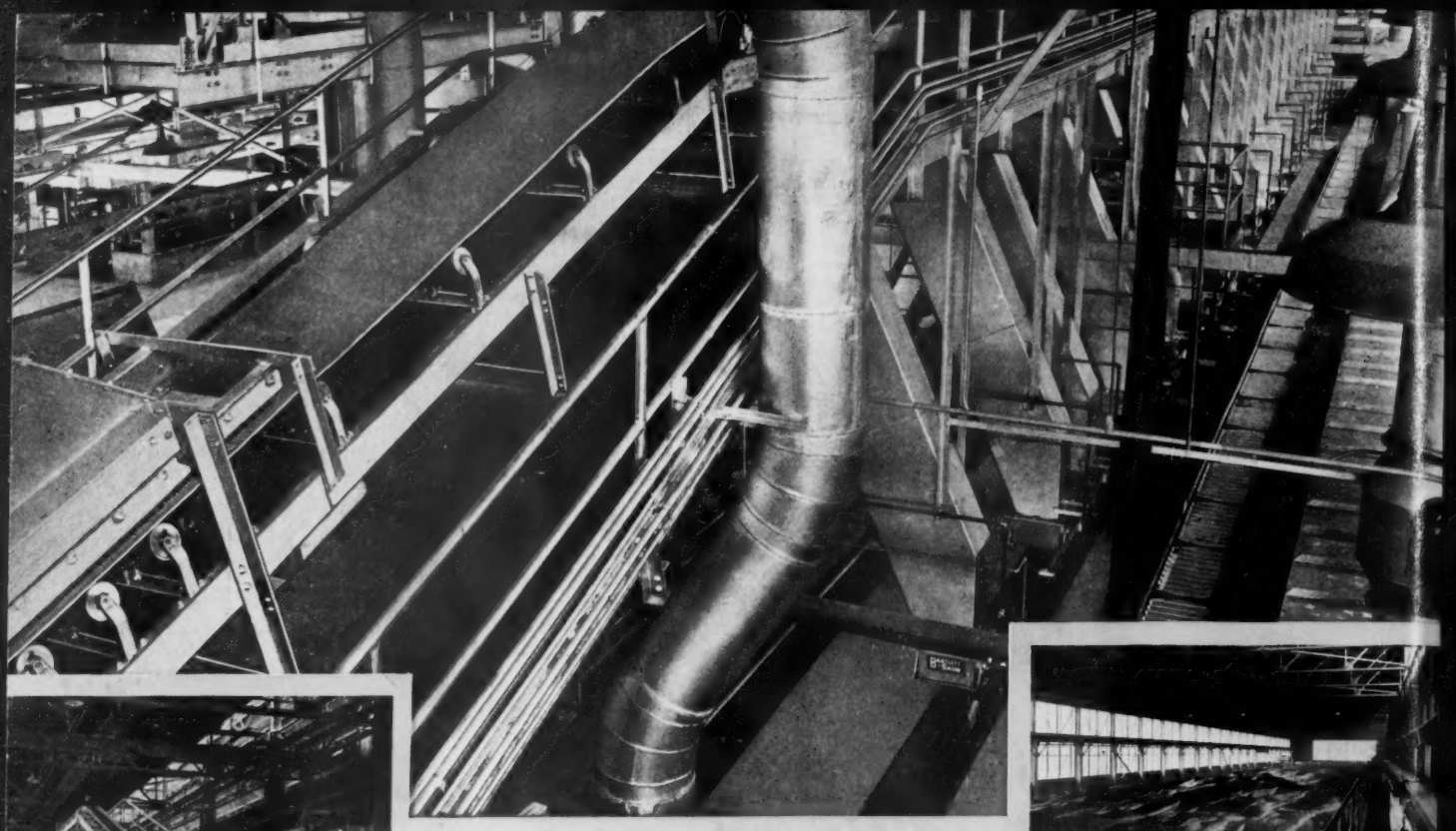

Above; View of Prepared Sand Handling and Distributing System in Large Automotive Foundry.

Above; View in Large Implement Foundry Showing Distributing System, Molders Hoppers and Mold Conveyor; At Right: Distributing Dried and Cooled New Sand to Bulk Storage Bin.

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shakeout
and
waste

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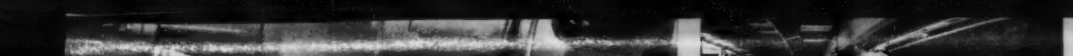
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